Agricultural Experiments and Demonstrations in Assam. Annual reports 1916-17 to 1918-19

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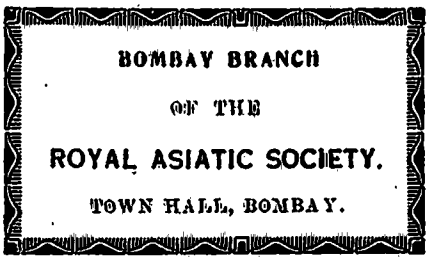

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ANNUAL REPORT

ON THE

AGRICULTURAL EXPERIMENTS AND DEMONSTRATIONS

IN

ASSAM

32908

FOR THE

YEAR ENDING THE 30TH JUNE 1917.

1916-17 & 1918-19 4

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Annual Report of the Jorhat Agricultural Experiment Station for the year ending the 30th June 1917.

Introduction.

This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most *rabi* crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented within culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of the raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag for instance, rather than in the form of acid superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years, in our own experience is clearly detrimental in the absence of periodic lime dressings on sour soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about 35½ acres, of which 1·7 acres is *hola* or ravine land and the remainder high land, which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is *hola* land and the remainder high land. The total area at present is thus 59½ acres. Most of the newly-added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth.

Soil.

The following report is by Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

Report on analysis of Jorhat Farm soil.

	Surface soil.	Sub-soil.
	Laboratory No. 5.	Laboratory No. 5(*a*).
1	2	3
Soluble in Hydrocloric acid with 12 hours' digestion at 100 C.	Per cent.	Per cent.
Phosphoric acid ($P_2 O_5$)	0·025	0·020
Potash ($K_2 O$)	0·115	0·135
Lime (CaO.)	0·154	0·144
Magnesia (MgO.)	0·166	0·148
Soluble in one per cent. citric acid with 7 days' digestion.		
Phosphoric acid	0·008	0·008
Potash	0·007	0·011
Loss on ignition (organic matter and combined Water).	3·26	1·84
Nitrogen	0·115	0·051
Calcium carbonate	0·048	0·018
Reaction	Acid.	Acid.

Physical Constants.

—	Hygroscopic capacity.	Maximum water saturation capacity.		Minimum water saturation capacity.		
		Per cent. of water in saturated soil by weight.	Per cent. of water in saturated soil by volume.	Per cent. of water by weight.	Per cent. of water by volume.	
1	2	3	4	5	6	7
Surface soil ...	3·10	31·9	50·5	11·2	13·9	1·3
Sub-soil ...	...	30·0	50·0	7·2	9·1	1·19

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime, is quite deficient in quantity.

Carbonate of lime has an enormous influence on a soil's welfare chemically, physically and bacteriologically.

Its effects on soil biological processes are in the right direction and very great; it also influences the texture of soils in a remarkable way, and is active in bringing into use the reserves of dormant plant food. Its presence in fair amount also ensures the most economical effect of any manuring given. Its absence forbids the use, for most cropping, of certain kinds of manures, unless liming be first resorted to.

Any upland soil containing such small amounts of total lime and lime carbonate as are here present will most certainly respond markedly in the case of most cropping to applications of lime.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

A good deal of the organic matter present is of a doubtful character and consists very probably of very old residues of little value; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one but in view of the absence in anything like adequate quantity of carbonate of lime, conditions for nitrification and soil bio-chemical processes generally are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in "total" as well as "available" supplies. There is thus a "real" as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus, high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself, very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application.

Turning to the physical constants, the hygroscopic capacity is low, and about what one would expect for this class of soil. It means that only water which is in excess about 3 per cent. is available for crops, and plants are able to reduce the soil moisture content to somewhere about this figure before they begin to wilt. The top 6 inches of soil even during the cold weather normals contains a good deal more moisture than 3 per cent. when under a close standing crop, so that usually there is sufficient water for the crop's requirements.

As regards maximum saturation capacity, these soils agree quite well with quoted figures for similar soils in Europe, and suggest that the optimum proportion of water for the growth of the plant is about 13 to 16 per cent. A recent determination of soil moisture in the surface 6 inches of the soil of this farm in August, some few hours after rain, gave 17 per cent. water. Soil moisture conditions are therefore probably extremely favourable for growth during the rainy season in normal seasons.

The figures for minimum saturation capacity are much lower than those cited (Hall, The soil, page 69) for similar soils in Europe, and this is probably due to the lower content of humus which obtains in our soils. This is an extremely important figure in gauging a soil's power to retain a reserve of moisture for crops during dry periods.

The sub-soil is worse in this respect than the surface layer, suggesting that the incorporation of organic matter, if it can be buried sufficiently deep, will have a great ameliorating effect.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crops will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures. No amount or combination of the latter can ever make up the case of a crop like sugarcane for loss of fertility due to shallow cultivation and lack of " humus ".

Buildings and machinery.

3. The farm is equipped with a godown, combined office and rest-house, quarters for Farm Manager, clerk and apprentices, cattle shed, Dutch barn, and is enclosed by " Ideal " wire fencing. A Hornsby oil engine and crushing mill was installed in 1911 for dealing with the cane.

Rainfall.

4. The rainfall recorded during the growing period of the crops referred to is given with the normal rainfall below :—

Month.	Actual rainfall, in inches.	Normal rainfall, in inches.
1	2	3
1916, April	8·14	8·54
„ May	7·87	9·26
„ June	7·88	11·36
„ July	12·29	14·76
„ August	14·78	15·15
„ September	10·95	9·18
„ October	6·63	4·07

Month.	Actual rainfall, in inches.	Normal rainfall, in inches.
1	2	3
1916, November	0·75	0·69
„ December	0·21	0·52
1917, January	0·77	0·93
„ February	5·76	1·32
„ March	1·35	3·90
Total	77·38	79·68

Remarks.

Rainfall was nearly normal and nicely distributed and the crops were generally sown under good conditions. The Christmas rains however failed us, and the *rabi* crops suffered in consequence to some extent. The cold weather was rather more severe than usual and this combined with heavy and continuous fogs retarded the ripening of the cane.

Experimental work.

5. Paragraph 5. The work of previous years was continued and extended as follows :—

I. Sugarcane experiments.

II. Soil investigations, and manurial tests.

III. Trials of new crops, or new varieties.

IV. Paddy selection.

Sugarcane.

6. The work includes the testing of varieties, manurial experiments, trials of different planting methods, and distribution of the best varieties. Over 1,07,000 cuttings were sent out during the cold weather.

No analysis was possible this year on account of the work at the Kamrup farm.

Sugarcane varieties. Ratoon Cane.

7. The following varieties planted in Block B in 1915 were ratooned :—

I. Phosphate area. Duplicate $\frac{1}{10}$th acre plots of B147, B376, and Striped Mauritius.

II. Non-phosphated area. Duplicate $\frac{1}{10}$th acre plots of B147, B376, and Striped Mauritius.

In addition $\frac{1}{10}$th acre plots of B208, *Gandari*, *Magh*, *Magh* sport, *Kheri* and Red *Tanna* were ratooned.

The results of the plant cane crop appeared in paragraph 8 of the last year's report.

The usual cultivation was given to the ratoon crop, the common manuring being 2,400 lbs. rape cake per acre given in three dressings. Harvesting took place from the middle of January 1917 to the middle of February. The results appear in Table I.

TABLE I.

RATOON CANE, 1916-17—BLOCK B.—(VARIETIES.)

(Figures are "per acre.")

Plot.	Variety.	Plot area.	Cane.	Juice.	Juice on cane.	*Gur.*	Remarks.
1	2	3	4	5	6	7	8
		Acres.	Lbs.	Lbs.	Per cent.	Lbs.	
1	B 376	$\frac{1}{10}$th	50,060	33,010	65·9	4,205	The (*a*) plots were on the phosphated area.
1*a*	B 376	$\frac{1}{10}$th	50,380	30,800	61·2	4,582	
4	B 376	$\frac{1}{10}$th	51,490	34,850	67·6	4,905	
4*a*	B 376	$\frac{1}{10}$th	51,920	33,570	64·6	4,105	
2	B 147	$\frac{1}{10}$th	45,750	28,790	62·9	4,443	
2*a*	B 147	$\frac{1}{10}$th	57,500	35,590	61·8	5,822	
5	B 147	$\frac{1}{10}$th	57,360	38,810	67·6	5,960	
5*a*	B 147	$\frac{1}{10}$th	55,960	34,790	62·1	4,966	
3	Striped Mauritius	$\frac{1}{10}$th	60,470	38,530	63·7	5,550	
3*a*	Striped Mauritius	$\frac{1}{10}$th	61,500	40,18 0	65·3	5,714	
6	Striped Mauritius	$\frac{1}{10}$th	59,980	39,840	66·4	5,853	
6*a*	Striped Mauritius	$\frac{1}{10}$th	62,360	38,960	62·5	5,509	
Magh ...		$\frac{1}{10}$th	19,360	11,560	59·7	1,271	
Magh sport		$\frac{1}{10}$th	45,240	26,530	58·6	3,703	
B 208 ...		$\frac{1}{10}$th	52,230	34,100	65·3	5,584	
Toona ...		$\frac{1}{10}$th	46,450	28,980	62·4	4,377	
Ganderi ...		$\frac{1}{10}$th	57,440	40,250	70·0	4,423	
Kheri ...		$\frac{1}{10}$th	63,960	32,050	50·1	3,900	

The ratoon crop is a considerable improvement on last year, the season being much more favourable. Striped Mauritius did best followed by B 208, B 147 and B 376. The local variety Magh as usual ratooned badly. A sport of this variety discovered some few years ago gave however more than twice the yield of cane and three times the amount of *gur* that its parent did.

Phosphated area.

The average increase of cane per acre due to application of phosphate was only some 2,500lbs., a much smaller increase than was obtained in the ratoons on Block E last year. The area on this Block (B) to which the phosphate was applied however was much the worst part of the Block, and it is very satisfactory that any increase at all was obtained.

Sugarcane varieties. Plant cane Block A.

8. In preparation for cane and following the usual rotation this block was green-manured with Cowpea in 1915, half the block being given a dressing of 5 cwts. Stane's Flour Phosphate per acre before sowing this crop. Rape was sown as a catch crop early in October 1915, and ploughed in while in flower in the middle of November. As usual both these crops made much heavier growth on the phosphated area. Sugarcane was planted in February 1916 direct into the plots on nice moisture.

The following varieties were tested against each other, B 147, B376, striped Mauritius, Kheri, Magh, Magh Sport, and two new promising varieties Barbadoes A and B 6450, plots of $\frac{1}{10}$th acre of each variety being provided on both phosphated and non-phosphated areas. Common manuring was 500 maunds cowdung per acre, half at planting and the remainder in two equal dressings at either earthing ; in addition certain plots received rape cake 15 maunds per acre as indicated on the following table. Harvesting took place in February and March 1917. The results appear 18 in Table II.

TABLE II.

PLANT CANE VARIETIES.—BLOCK A.

(Figures are per acr e.

Plot.	Variety.	Manuring.	Cane.	Juice.	Juice on cane.	*Gur.*	Remarks.
1	2	3	4	5	6	7	8
1	B 147	Per acre. Cowdung.	Lbs. 54,080	Lbs. 34,820	Per cent. 64·4	Lbs. 6,594	(a) The plots were on the phosphated area.
1(a)			64,610	42,640	66·0	7,544	
2	Striped Mauritius	40,000 lbs.=100 lbs. nitrogen.	71,340	49,800	69·8	8,610	
2(a)			82,250	55,930	68·0	8,979	
3	B 376		62,320	43,120	69·1	6,785	
3(a)			67,960	45,860	67·8	7,268	
4	B 147	Cowdung.	64,960	40,000	61·6	8,303	
4(a)			75,340	50,170	66·6	8,763	
5	Striped Mauritius	40,000 lbs. + 1,200 lbs. rape cake = 150 lbs. nitrogen.	76,370	.....	.....	.....	
5(a)			78,680	.....	.....	.....	
6	B 376		56,480	41,320	73·1	6,424	
6(a)			65,810	44,730	68·1	7,560	

7	Barbadoes ▲	Cowdung 40,000 lbs. ...	80,360	54,420	67·7	7,970
7(a)			88,160	60,220	68·3	8,456
8	B 6450		57,920	39,420	68·0	7,780
8(a)			60,140	41,460	68·9	7,841
9	Magh Sport		60,470	40,400	66·8	...
9(a)			67,490	44,670	66·2	...
10	Magh		38,140	26,650	69·9	...
10(a)			48,880	33,820	69·6	...
11	Kheri		79,875	43,160	54·1	6,726
11(a)			79,200	46,975	60·0	6,714

As the figures show the crop was a very good one, the average yield per acre for the whole of the varieties being 30 tons, while a new variety Barbadoes A gave 39·4 ton per acre on the phosphated area. Both new varieties Barbadoes A and B6450 gave a very good account of themselves, and promise well. Barbadoes A is a medium thick cane of erect habit, hard and tillers well, is clean and has no signs of disease, and has prominent buds.

B6450 is thicker, and also erect, medium hard, tillers fairly well, is clean and has no signs of disease, and has medium buds.

The other exotic varieties all did very well with striped Mauritius best. The sport of the local variety *Ma,h* again easily beat its parent.

Phosphated area.

The phosphated plots in almost every case gave a considerable increase over the non-phosphated but otherwise similarly manured plots, the average increase for the whole area being almost exactly 3 tons stripped cane per acre. Valuing the cane at five annas per maund (80 lbs.), this gives a profit on the first cane crop of Rs. 10 per acre. The ratoon cane and the other crops in the rotation should increase this profit considerably.

Rape cake application.

As shown in Table II, 6 plots received 150lbs. nitrogen per acre as cowdung and rape cake, while 6 other plots were given only 100lbs. nitrogen as cowdung. The average increase per acre due to the rape cake is some 2,850lbs. stripped cane, valued at Rs. 11. The cake costs Rs. 30 per acre. With our rotation, including a green-crop and a catch crop of rape in the year previous to cane, it evidently does not pay to use cake in addition to the cowdung used.

Sugarcane planting experiment. Ratoon.

9. Commenced in Block B in 1915 ; the plant cane results appear in paragraph 10 of last year's report. Cane rows were 4 and 5 feet apart respectively, and different methods of planting were adopted, providing in the former case from 5,600 to 18,200 sets, and in the latter 4,600 to 15,000 sets per acre. B147 was the variety used. Manuring was 2,400 lbs. rape cake per acre. The results appear in Table III.

TABLE III.

BLOCK B.—RATOON CANE, 1916-1917.

Planting Experiment.

Plot.	Method of planting.	Plot area.	Number of rows.	Width apart of rows.	Number of sets per acre.	Weight cane per acre.	Weight cane per row.	Remarks.
1	2	3	4	5	6	7	8	9
		Acres.		Ft.		Lbs.	Lbs.	
1	Ordinary method	$\frac{1}{10}$th	5	4	5,930	64,780	1,295	The ordinary method of planting consists in disposing the sets 2 ft. apart centre to centre in the rows.
2	Sets end to end	$\frac{1}{10}$th	5	4	10,230	68,360	1,367	
3	Double row ordinary	$\frac{1}{10}$th	5	4	10,000	65,300	1,306	
4	Double row end to end	$\frac{1}{10}$th	5	4	18,230	56,380	1,128	
5	Ordinary method	$\frac{1}{10}$th	4	5	4,600	56,300	1,420	
6	Sets end to end	$\frac{1}{10}$th	4	5	8,220	55,350	1,389	
7	Double row ordinary	$\frac{1}{10}$th	4	5	8,660	46,920	1,148	
8	Double row end to end	$\frac{1}{10}$th	4	5	15,000	57,600	1,440	

Though wider planting has given a bigger weight of cane per row, the narrower planting has this year given much bigger ratoon crops per acre. Combining these figures with those for the plant cane last year, we arrive at the following total yields of cane for the two successive crops :—

Plot.	Lbs.
1	115,080
2	118,180
3	124,950
4	116,440
5	98,000
6	102,090
7	99,640
8	101,880

The figures bear out previous years' results in that the narrower planting gives the bigger crops, while not more than 8,000 —1,000 sets per acre cane be economically used.

New varieties of cane.

10. Two of the new varieties received from Barbadoes in 1914, Barbadoes A and B6450, were given field plots this year, and did very well, one of them giving nearly 40 tons stripped cane per acre, *vide* paragraph 8.

Six more received 1915 from the Government sugarcane Expert Coimbatore were multiplied in the nursery, B 3412 and J 33 A did well, while J 247 was only medium. These three varieties have been given field plots this year 1917.

Java Hebbal, B 1529 and Red Sport of Striped Mauritius were very poor and are being taken on another year in the nursery.

Three new varieties have been received this year, *viz.*, Red sport of Striped Mauritius *ex*-Kamrup Farm, Ashy Mauritius and Kala Bombai.

Soil investigation.

11. The various experiments bearing on this work were continued; they are as follows :—

Block G : Liming experiment, commenced 1909.

„ C : Liming and manurial experiment; also a wood ashes experiment, commenced 1911.

Block K : Experiments to ascertain the reasons for the pronounced effect of lime on the farm soil, commenced 1912.

Block L : Ground lime-stone experiment, started in 1913.

Blocks E, B, A, and D: Experiments in the use of raw mineral phosphate, initiated 1913, 1914, 1915 and 1916, respectively.

For previous details the reports for 1912—1916 may be seen.

Block G. Liming experiment

12. Half this block was limed 8 years ago, and both sides are regularly and similarly cropped with a view to determine how long the effect of the single lime dressing will last. The cropping this year was cowpeas for green-manure in the rains, and the usual crops *matikalai*, oats, gram and rape in the cold weather.

Cowpeas as usual did well on the limed and poorly on the unlimed-area.

In the cold weather all the crops died out soon after germination on the unlimed side. On the limed side fair crops of oats and *matikalai* were harvested ; gram and rape made fair vegetative growth but matured no grain. Thus the lime effect is still quite marked though 8 years have elapsed since the lime was applied.

Block C. Liming and manurial Experiment.

13. Commenced in 1911 this experiment was continued in its 6th year.

Those plots which had 10 maunds (=800lbs.) lime per acre annually from 1911—15 were given a sixth dressing of 10 maunds per acre in 1916, the annual cross dressing of bonemeal and cowdung being applied to their respective plots as usual.

All the limed plots have now had 60 maunds (4,800lbs.) slaked lime per acre, applied variously as one initial dressing, or two triennial dressings of 2,400 lbs. each, or six annual ones of 800lbs.

Observations during growth.

The cropping for 1916-17 was *jowar* in the rains and gram in the cold weather. The *jowar* was sown in drills whereby it was found possible to keep the plots clean by intercultivation, thus eliminating weed competition. *Jowar* germinated well, but all the plots were more or less attacked by crickets, some of the plots becoming patchy in consequence, more particularly on the green-manured block. The crop throughout was darker green and stronger looking on the green- manured area.

All the limed plots grew strongly throughout ; the non-limed plots made a distinct struggle for existence, particularly those annually cross-dressed with both cowdung and bonemeal, but the crops were practically negligible. The various cross-dressings showed up well as the plots were kept thoroughly cultivated and clean, and thus the competition by weeds, which spoilt the *jowar* results of two years ago,* was eliminated. Bonemeal had a well marked beneficial effect, but after lime this crop always responds most to cowdung. Of the limed plots those which had the

* *Vide* report of the Jorhat experiment station for 1915, paragraph 13.

smaller lime dressings annually or triennially (see Table IV, plots 2, 3 and 6, 7) were throughout the growing period much in advance of the plots which had the single large initial dressing.

The crop was cut green for fodder in September.

Gram was sown in October. It did well at first on the limed sections ; the dry season however went against it. It flowered late and the heavy rains in February rotted the seeds in their pods. Threshing was impossible, thus no records are available.

The records for the *jowar* crops appear in Table IV.

TABLE IV.

BLOCK C.—JOWAR.—*Sixth year of Experiment.*

(Figures are per acre.)

Cross-dressings.	Non green-manured block.				Green-manured block.				Remarks.
	No lime. Plot 1.	Lime total 4,800 lbs. (800 lbs. annually for 6 years). Plot 2.	Lime 4,800 lbs. (2,400 lbs. triennially). Plot 3.	Lime 4,800 lbs. initially. Plot 4.	No lime. Plot 5.	Lime total 4,800 lbs. (800 lbs. annually for 6 years.) Plot 6.	Lime total 4,800 lbs. (2,400 lbs triennially). Plot 7.	Lime total 4,800 lbs. initially. Plot 8.	
1	2	3	4	5	6	7	8	9	10
	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	
A. Nil	Nil	10,960	9,680	7,390	Nil	10,200	9,420	7,280	
B. Bonemeal 240 lbs. per acre annually 1st—6th years.	50	13,540	14,640	11,440	100	12,940	11,560	6,300	
C. Bonemeal 240 lbs. *plus* cowdung 8,000 lbs. per acre annually in 1st—6th years.	1,630	17,990	16,580	14,360	1,220	18,440	19,760	1,11,000	
D. Cowdung 8,000 lbs. annually per acre in 1st—6th years.	290	18,440	14,760	15.340	880	18,760	19,200	13,500	

Lime dressings.

In regard to the differential lime applications the evidence of the *jowar* crop, is in this the sixth year of the experiment, in favour of the smaller and more frequent dressings, *cf.* plots 2, 3, and 4, the relative crops being respectively as 125 : 114 : 100, and plots 6, 7 and 8 the relation being as 158 : 157 : 100. This bears out last year's evidence that the apparent superiority of the heavy initial dressings is giving way in favour of the smaller recurring ones as time goes on.

Cross-dressing.

It is curious that though bonemeal when used alone has given a distinct increase over the check plots (*cf.* section B with corresponding plots of section A), when used in addition to cowdung it does not on the average increase the yield (*cf.* sections C and D), the aggregate yield for these two sections being almost identical. Given a good d ressing of lime and cowdung, the use of bonemeal for *jowar* would not appear to be economical.

Value of organic matter

The aggregate yield for the green-manured area is very slightly less than for the ungreen-manured area, the crops being in the proportion of 100 : 104. This may be explained by the facts (1) that the green-manured area carried a very much heavier crop of oats in the preceding cold weather, (2) crickets did much more damage to the *jowar* here than on the ungreen-manured area.

The value of organic matter is emphasized by the following analysis of the table :—

	Relative yield of *Jowar*.	
	Cowdung plots.	Non-cowdung plots.
For whole area	161	100
Non-green-manured block separately.	147	100
Green-manured block separately	178	100

Wood ashes experiment.

14. This experiment was commenced in 1911.

Five plots receive respectively 5, 10, *nil*, 15 and 20 maunds (1 maund=80 lbs.) wood ashes per acre per annum. Half of each plot is cross-dressed with cowdung 100 maunds per acre per annum.

Cropping in this, the sixth year, was *jowar* followed by *Kulthi-kalai*. The latter crop, a new crop to the farm, was apparently sown too late, for though it made good vegetative growth it failed to ripen its seeds before the February rains ruined it.

The *jowar* was cut green for fodder in August ; the yield were as follows :—

		Green-Jowar.
Plot 1	5 maunds ashes per acre ...	Nil.
	5 „ *plus* cowdung	1,211 lbs.
Plot 2	10 „	392 „
	10 „ *plus* cowdung	3,689 „
Plot 3	Nil	Nil.
	cowdung	Nil.
Plot 4	15 maunds ashes per acre ...	2,079 lbs.
	15 „ *plus* cowdung	8,456 „
Plot 5	20 „	5,243 „
	20 „ *plus* cowdung	11,284 „

The crop yields increased largely with every increase in the amount of ashes used, and the 15 and 20 maunds ashes plots now produce fair crops of *jowar*, especially where used along with cowdung. The improvement in these plots is enormous ; four years ago *jowar* was tried and died out very early over the whole area. This experiment should serve as an incentive to cultivators to preserve their ashes along with their cowdung.

Block L. Ground lime-stone experiment.

15. Commenced 1913 on very poor and infertile newly broken up land. The scheme consists of 6 plots of 1-3rd acre each in two series, of 3 plots each. One series Section A, is cultivated shallow with country implements, the other Section B being worked deeper with English ploughs. Ground limestone was applied as follows in 1913 :—

Sections A and B	Plot 1 ...	15 maunds lime-stone per acre.
	„ 2 ...	Nil.
	„ 3 ...	30 maunds lime-stone per acre.

For further details of the scheme see previous years' reports.

The cropping this year was cowpeas for green-manure in the rains, followed by wheat in the cold weather. Cowpeas did well all over, being best however on the limed plots ; the crop was hoed in during July. Wheat germinated well all over, but died out very early on the unlimed plots.

The wheat led all the way through on the shallow cultivated Section A, otherwise improving with increase in the lime-stone application on either section. It tillered very badly indeed and

uffered much from the failure of the usual December rains. Nowhere did the wheat make even a fair crop; this is not a wheat soil. Knowing this however the crop was purposely grown as being a deep rooter, and to confirm the results obtained in the previous year. The yields of grain were as follows :—

	Plot 1.	Plot 2.	Plot 3.
Section A (shallow cultivation)	7lbs.	nil	166lbs.
Section B (deep cultivation)	5 ,,	,,	61 ,,

The results agree well with those obtained last year for wheat, and the indications are similar to those given by oats, which is a much shallower rooter. For these two crops wheat and oats, at any rate, using only moderate lime dressings, it will pay to keep the lime near the surface. Both crops appear to be very susceptible to soil acidity in the seedling stage, and this factor, within the limits of the experiment, appears to be a more potent one than that of depth of rooting, in deciding to what depth a given application of lime-stone shall be incorporated with the soil by cultivation.

Block K. Experiment to ascertain the early functions of lime.

16. This experiment commenced in 1912 was continued in its fifth year. The results obtained during the year with oats and *jowar* go to confirm and strengthen those of previous years. Reference may be made to the Jorhat farm reports for 1913 *et sequa* and also to a Memoir entitled " Studies of an acid soil in Assam " published as No. 9, Volume III, Chemical Series of the Memoirs of the Department of Agriculture in India.

The *jowar* crop, now grown for the first time on these plots, specially emphasized the need of lime or some other acidity neutraliser, also indicating the importance of phosphatic manuring; further it became very marked that it is only after the soil's requirements for lime and phosphate have been met, that one can expect a response in crop production to additions of artificial manures such as sulphate or muriate of potash, nitrates of soda potash or lime, sulphate of ammonia, etc.

The toxicity of those plots which annually get a dressing of sulphate of ammonia in the absence of lime becomes more marked year by year.

With lapse of time this experiment is furnishing evidence in regard to those manures which tend to liberate available potash from the potash reserves in this soil. From the outset certain weeds established themselves very strongly on those plots which received direct additions of potash manures. These same weeds are now gradually year by year becoming more prominent

on other plots which get no potash at all; these are the carbonate, sulphate, and nitrate of lime plots, and it appears to be the fact that of the various manures used, these are most potent in liberating available potash.

17. *Blocks E, B, A and D.*—Flour phosphate experiments in the Sugarcane Rotation.

About 1 acre of each of the four blocks which regularly come under cane two years out of four, has been dressed with flour phosphate with a view to observing its effect on the various crops in the rotation.

The phosphate is applied in the fourth year of the rotation previous to sowing the green-crop of cowpeas. The present rotation is as follows :—

1st Year	... ...	Plant cane.
2nd „	... ...	Ratoon cane.
3rd „	... ...	Rains—Green-crop of *dhaincha*. Rabi—Oats.
4th „	... ...	Rains—Green-crop of cowpeas. Rabi—Catch crop of rape ploughed in mid November.

As there are four blocks in the cane rotation, and this experiment was only commenced in 1913, much information is naturally not yet available.

The rotation has been completed on Block E only, so far; in the year of application the phosphated area, made a much better cowpea crop, and gave an increased yield of 210 lbs. per acre of rape seed valued at Rs. 11-10; during the first and second years of the rotation, the average increase per acre for the two crops of cane was 9,200 lbs. valued at Rs. 36; in the third year the *dhaincha* made a much better crop on the phosphate area, while this area gave an increase of 200 lbs. oats per acre in the following cold weather, valued at Rs. 7-8. The total value of the increase is Rs. 55-2 at a cost for phosphate of Rs. 15-12, leaving a net profit of Rs. 39-6 per acre.

The other blocks in the rotation are giving similar results. The effect of the phosphate on the plant and ratoon cane crops of the year under report is discussed in paragraphs 7 and 8 of this report.

Block D was the area to receive the phosphate this year, one acre being thus treated. The following crop of cowpeas made particularly fine growth on the phosphate area, though also

good on the untreated area. Rape was grown as a catch crop and ploughed in mid November while in flower, making a 16-anna crop on the phosphated area and an 8-anna crop on the other.

Extension area. Block M.

18. This block was under Java Natal indigo, one acre being sown on limed and one acre on unlimed land. Sown in May, harvesting took place from December to March. The crop did very well on the limed area and set a fine crop of seed, which was however ruined by a heavy hail storm just previous to ripening, with the result that only about one-third of the seed was recovered, *viz.*, 254 lbs.

The crop on the unlimed land died off while young.

Blocks O and R.

Sugarcane for distribution.—The whole of this cane was used for distribution, some 107,000 sets of the three varieties, B 376 Striped Mauritius and B 147 being sent out from the farm this year.

Other crops. Blocks E and F.

19. These blocks were green-manured with *dhaincha* following ratoon cane. The crop did well everywhere, especially on the area phosphated in 1913 where the *dhaincha* was ready for ploughing in fully a fortnight before that on the sorrounding unphosphated land.

Oats was taken as the cold weather crop, and also did quite well, the average outturn being 960 lbs. grain per acre. The phosphated area gave an increase of 200 lbs. grain per acre over the untreated area, and ripened off earlier.

Block H.

Cowpeas for seed were sown here, selected seed from the previous year of quick-growing heavy-cropping varieties being used. The seed was sown mid-August in rows 2 feet apart, seed rate 10 lbs. per acre, and the plants were subsequently thinned out 2 feet apart in the rows. The crop was harvested from November to January and yielded 800 lbs. excellent seed per acre.

Kitchen garden.

A variety of crops was grown here for observation, comparison and selection, *e.g.*, cowpeas (varieties); soy beans (varieties); Java Natal indigo; ground nuts (varieties); sunn hemp and *dhaincha* for seed; lucerne and beerseem.

Cowpeas.

Five varieties were grown, the one named "Jorhat Brown" again being the best. This variety grows extremely rapidly, making a very bulky and succulent green-crop with 6 weeks growth, and not forming vines so early as most other varieties. It also seeds very freely if sown about the middle of August.

Soy beans. Shillong soy beans gave 2,160lbs. seed per acre as against 1,980 lbs. for the farm variety.

Ground nuts. Four varieties were grown on plots of 768 sq. ft. area; yields as follows :—

Virginia ...	...	...	1,700 lbs. per acre.
Big Japan	...	...	1,590 „ „ „
Raipur ...	...	...	1,360 „ „ „
Farm seed	...	...	1,250 „ „ „

Lucerne. This crop, a most excellent fodder, has been tried for the past 2 years. It requires well drained good loamy soil, and the land must be absolutely clean, *i.e.*, free from weeds if the crop is to persist. Lime should be liberally applied some time before sowing and deeply worked in, if the soil is sour or deficient in lime. A dressing of 3 cwt. basic slag per acre, or failing that of finely ground bone-meal, will materially help the crop; well rotted cowdung if available should also be freely used. Where this crop has not been previously grown, a dressing of soil from an old lucerne patch at the rate of 100 lbs. per acre, if applied previous to sowing and light-hoed in immediately after spreading, may give excellent results, as it did with us. Soil for this purpose can be supplied by the Farm Manager on application. The crop suffers from hot sun in its early stages, and should not be sown too early. As the seasons vary considerably, nothing but making experimental sowing at different times say from the middle of November onwards till January can decide the best time for sowing. In our experience sowings made towards the end of December immediately after the Christmas rains, when these do not fail, give very good results. This year the December rain failed us, and the crop was not sown till after rain about the end of January, and did not do so well. Where irrigation is available sowings made throughout December should do well.

On weedy land, or where irrigation can be practised, the crop is better sown in lines 18 inches to 2 feet apart; this permits of inter-cultivation and weeding. Otherwise it does well sown broadcast at the rate of 15 to 25 lbs. seed per acre, according to the nature of the soil. Excellent seed can be obtained from Pestonjee Pocha & Sons, Poona.

Three cuttings of fodder should easily be obtained, and if drainage is very good, the crop may even extend over the rains into a second season : otherwise it must be re-sown every year. In our case, three cuttings were possible, the first giving at the rate of 6,400 lbs. green fodder per acre, or nearly three tons.

The 2nd and 3rd cuts were slightly lighter, but were unfortunately not weighed. Weeds, which are a veritable curse to lucerne, gradually wore down the crop; after the third cutting it was therefore grazed off and hoed up.

Beerseem.

This crop was tried in the cold weather both on high land, and also in a paddy *hola* after the water had subsided. In both cases it failed miserably as irrigation was impossible on the high land, whereas in the *hola* conditions were apparently too wet.

Orchard.

20. Fruit trees comprise 16 lichis, 6 mangoes, one custard apple, 3 sepota, 5 guavas, 1 pomelo, 1 plum and 3 papaya besides several varieties of plaintain. Most of the trees fruited well except the mangoes.

Receipts and expenditure.

21. The receipts from sale-proceeds amounted to Rs. 3,578-0-9 or nearly Rs. 1,000 more than last year. The total expenditure including cost of establishment and charges on capital account amounted to Rs. 11,642-6-5.

Establishment.

22. This consists of a Manager on Rs. 100—10—200; clerk on Rs. 25—1-8—40 and a peon on Rs. 8. The number of apprentices on the farm during the year was nine, one of whom Sheikh Karim Box proceeded to the Agricultural College, Sabour, in June. Two completed their training—*Chandi Charan Dutta* and *Biswanath Dutta* and were appointed temporary Demonstrators from 1st November 1916.

The following new apprentices joined, Krishna Chandra Gogoi, Kantiram Gogoi, Lakshi Nath Barua, and Nirmal Chandra Kakati, the two latter being Nowgong men.

Srijut Binaram Das held the post of Manager throughout the year.

Inspection.

23. The Director of Land Records and Agriculture, Assam, inspected the farm three times. The Acting Deputy Director of Agriculture, Assam Valley, being in residence at Jorhat was in constant touch with the farm throughout.

JORHAT :
The 30th July 1917.

A. A. MEGGITT,
Acting Deputy Director of Agriculture, Assam Valley.

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 30TH JUNE 1917.

History and description.

The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road, 5½ miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the place is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The total area of the farm is 366·67 acres, of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies in a long narrow valley. The bottom of the valley was formerly a marsh which was of very little value for any purpose, it has recently been converted into firm pasture ground by deepening the stream which drains the valley and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil is of a very pronounced reddish colour and of great depth. In a small portion of the cultivated area the soil is black owing, it is believed, to the existence of some mineral compound. At the botton of the valley, a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having long been under a thick growth of grass, the uppor portion of this soil is a matted mass of half decayed grass-roots.

In point of quality the soil of the farm is extremely poor, and very little can be grown on it without the help of manure.

The greater part of the station suffers from the disadvantages of an exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter, the growth of vegetation is entirely suspended.

Purposes of the station.

2. The main objects for which the station is maintained are the trial and introduction of new varieties of potatoes which are the most important among the crops grown on the plateau of the Khasi Hills, the breeding of improved strains of milch cattle suitable for this tract and the cultivation of fodder crops for their upkeep. Fodder experiments have been tried from time to time,

but having proved abortive, they have one after another dropped out of the programme of the farm. Very little experimental work beyond the potato trials is done at present on the farm, and if we leave out the cattle and the fodder crops grown for them, the station may be looked upon more as a seed-growing farm than one devoted to experimental work.

3. The following table gives the rainfall during the official agricultural year under report:—

Weather.

Rainfall.

—	Actual, 1916-17.	Normal.	Number of rainy days, 1916-17.
1	2	3	4
1916.			
July	13·78	17·75	23
August	22·81	15·67	23
September	11·18	11·06	19
October	18·78	7·55	15
November	4·26	1·27	4
December	0·03	0·18	...
Total for six months	70·84	53·48	84
1917.			
January	...	0·29	...
February	1·82	1·02	4
March	1·86	2·25	4
April	·57	4·48	1
May	11·23	8·83	17
June	14·84	20·04	21
Total for six months ...	30·32	36·91	47
Total for year	101·16	90·39	131

These 12 months really cover parts of two different agricultural seasons, as on the plateau of the higher Khasi Hills the cropping season commences in February and ends in November.

The autumn rainfall was heavier than usual and this, while suitable for the winter potato crop, was unfavourable for hay making.

A severe drought in spring checked germination of the potato sets, and delayed the sowing of all fodder crops. A period of heavy rainfall in May and June produced conditions favourable to potato disease, with the result that this year's outturn is likely to prove small.

The other crops will give a smaller outturn than usual. The maize crop is a moderate one, Job's tears and Raishan (paspalum sanguinale) are poor, and owing to the early check in growth caused by the drought the upland rice is very light also.

4. The work done during the year included :—

Summary of work.

(1) Trials of different varieties of potatoes.
(2) Growing potatoes for seed.
(3) An experiment in warping of rice land.
(4) Trials of new crops.
(5) Fodder crops.
(6) Cattle breeding.
(7) Distribution of seeds, implements, etc.

5. The 13 varieties tested in 1915 were planted in the following year in addition to nine varieties imported from Messrs. Sutton & Sons in 1915, thus making a total of 22 varieties tested in 1916. The newly imported varieties were Magnum Bonum, Up-to-Date, Windsor Castle, Stirling Castle, Epicure, Edinburgh Castle, Dover Castle, Balmoral Castle and Acquisition. Where it was possible each variety was planted in duplicate plots of 1/40th acre each. All the varieties were planted in March and harvested in August, and winter seed was used in each case. The land was manured with 11 tons cowdung and 823 pounds of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 240 gallons per acre, applied in two equal doses.

Trials of varieties of potatoes.

The outturns of each variety in 1916 and in previous years are exhibited in the following table :—

Statement showing the average yield per acre on duplicate plots for the last nine years.

Variety.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last five years.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	
1. King of Potatoes	9·20	6·33	8·0	6·84	8·58	7·37	4·82	3·51	11·7	7·79	
2. Magnum Bonum (1908)	9·25	6·77	7·85	6·07	8·51	5·90	4·86	3·22	10·16	7·69	
3. King Edward VII	7·35	4·61	6·17	4·90	4·58	6·0	2·88	3·31	9·87	5·54	
4. Khasi Nainital	8·71	5·43	6·93	6·39	6·11	5·78	4·36	4·10	10·7	6·72	
5 Khasi Round	5·89	4·98	4·52	4·51	4·09	4·95	3·40	3·76	9·35	4·80	
6. Windsor Castle (1909)	8·28	6·01	7·70	5·81	7·53	6·65	2·32	...	...	7·07	
7. British Queen (,,)	9·12	7·36	7·19	5·60	6·66	6·96	3·40	...	...	7·19	
8. Up-to-Date	9·75	6·12	7·62	6·84	6·53	5·61	3·30	...	...	7·37	
9. Magnum Bonum (1912)	8·91	4·93	6·24	5·72	8·22	...	...	...	...	6·80	
10. Windsor Castle (,,)	10·12	6·20	8·75	4·73	7·19	...	...	...	...	7·40	
11. British Queen (,,)	7·95	6·19	6·66	5·23	2·66	...	...	...	...	5·73	

12. Flour Ball	...	...	...	...	...	4·54	4·94	5·22	5·9	6·35	...	...	...	...	5·39
13. Imperator	...	...	...	...	...	7·86	6·84	6·73	6·14	7·74	...	...	...	...	7·06
14. Magnum Bonum (1915)		...	...	...	...	2·34	...	...	...	...	...	...	...	...	...
15. Up-to-Date	(„)	...	...	...	...	2·16	...	...	...	...	...	...	...	...	...
16. Windsor Castle	(„)	...	...	...	...	1·70	...	...	...	...	...	...	...	...	...
17. Stirling Castle	(„)	...	...	...	...	2·57	...	...	...	...	...	...	...	...	...
18. Epicure	(„)	...	...	...	...	4·71	...	...	...	...	...	...	...	...	...
19. Edinburgh Castle	(„)	...	...	...	...	2·80	...	...	...	...	...	...	...	...	...
20. Dover Castle	(„)	...	...	...	...	3·38	...	...	...	...	...	...	...	...	...
21. Balmoral Castle	(„)	...	...	...	...	2·37	...	...	...	...	...	...	...	...	...
22. Acquisition	(„)	...	...	...	...	1·28	...	...	...	...	...	...	...	...	...

The year 1916 was the second season for the new varieties, and, as usually happens, they have not given a very heavy yield during their first two seasons. However as the seed has now become acclimatised, results more in agreement with those obtained from the older varieties may be expected in future. Epicure, with 4·7 tons per acre, gave the heaviest outturn of the nine new lots. Of the 13 older varieties, Windsor Castle gave the largest crop, Up-to-Date, King of Potatoes and British Queen being very little behind. From the average yields given by these four varieties during the past five years, there would seem to be little to choose between them with regard to their cropping powers.

Of the 22 varieties grown in 1916, Windsor Castle (1909) has been omitted in the present year (1917), as the same variety imported in 1912 has proved slightly superior.

Three other varieties, Arran Chief (1916), King of Potatoes, (1916), and King Edward VII (1916) have been added. The total number of varieties at present under experiment is therefore 24. As the crop is not yet harvested, the results will appear in a future report:—

Varieties.	Number of diseased tubers out of 50 examined.						
	1910.	1911.	1912.	1913.	1914.	1915.	1916.
1	2	3	4	5	6	7	8
King of Potatoes	12	Nil	Nil	Nil	1	5	3
Magnum Bonum (1908)	6	4	2	4	2	Nil	1
King Edward VII (1906)	18	8	4	6	5	4	1
Khasi Nainital (1908)	48	16	8	4	4	8	Nil
Khasi Round (1900)	4	8	8	10	6	6	10
Windsor Castle (1909)	...	...	4	3	3	12	2
British Queen (1909)	12	...	6	4	2	8	2
Up-to-Date (1909)	4	32	16	4	1	6	4
Magnum Bonum (1912)	...	...	6	6	2	2	1
Windsor Castle (1912)	...	...	4	3	2	10	1

Varieties.	Number of diseased tubers out of 50 examined.						
	1910.	1911.	1912.	1913.	1914.	1915.	1916.
1	2	3	4	5	6	7	8
British Queen (1912)	...	...	4	4	3	6	1
Flour Ball (1912)	...	...	6	3	1	10	1
Imperator (1912)	...	...	22	3	6	4	6
Stirling Castle (1915)	...	...	...	...	...	...	10
Epicure (1915)	...	...	...	...	...	...	5
Magnum Bonum (1915)	...	...	...	...	...	...	5
Dover Castle (1915)	...	...	...	...	...	...	4
Up-to-Date (1915)	...	...	...	...	...	...	1
Windsor Castle (1915)	...	...	...	...	...	...	2
Edinburgh Castle (1915)	...	...	...	...	...	...	3
Balmoral Castle (1915)	...	...	...	...	...	...	5

Potato disease caused by Phytophthora Infestans is often responsible for considerable damage to the potato crop in the Khasi Hills. This year the damage to the farm crop was greater than usual, owing to growth being delayed by an early drought, which was followed by rather heavy rainfall in May and June, and an early appearance of potato blight. Preventive spraying is as thoroughly and systematically carried out on the farm every year as weather conditions permit.

In the present year part of the crop was sprayed twice with Bordeaux mixture, at 120 gallons per acre each time, the balance being sprayed once at the same rate.

Notwithstanding this treatment, growth ceased early, and the crop is yielding a smaller outturn than in the previous year.

The seven new types of potatoes, bred at the farm in 1914 from seeds of the variety Flour Ball, and grown since that time, were planted again in the spring of 1916. Their respective

yields are as follows:—

—	Area.	Quantity planted.	Yield per acre.
1	2	3	4
	Acres.	Seers.	Tons.
Type I	1/80	5	5·79
„ II	1/80	5	3·03
„ III	3/160	5	4·01
„ IV	1/80	4½	3·44
„ V	1/40	10	5·68
„ VI	1/80	5½	4·44
„ VII	1/160	3½	3·22

The plots were manured with cowdung at 11 tons, and rape cake at 823 pounds per acre.

Although a certain amount of selection has been done with these types, they do not yet seem to be pure. They have been further selected this year and are being tested on a field scale again this season.

Potato seeds from St. Andrew's University.

Twenty lots of seed were obtained in February 1916 from St. Andrew's University, through the kindness of Mr. Donald Ferguson of Dhamai Tea Estate, Sylhet, Honorary Correspondent of the Department. Half of each lot of seed was sown in boxes on 20th February 1916, and the remaining half was sown similarly on 19th March 1916. Out of the twenty lots numbers four and twenty failed to germinate. The others grew satisfactorily, and the seedlings were planted in the field on the 15th March 1916.

Two lots of seed produced only one plant each, and as one of these plants failed to form any tubers, the total number was reduced to nineteen. Two lots were destroyed by insects and the remaining seventeen gave widely varying yields. The potatoes obtained from them were again planted in the present year. The results have not yet been obtained, but there were several promising types among them. As seedling potatoes generally require to be grown for two or three seasons before they give anything like their full yield, little information can be expected until these have been tested on a field scale for another year.

Potato manurial experiment.—An experiment designed to shed some light on the respective manurial values of rape cake and bonemeal for the potato crop was laid down in 1916 and repeated in the present year. This experiment was put down in duplicate on a series of plots of King of Potatoes, and a similar duplicate experiment was carried out with Megnum Bonum. The seed-rate was 987 pounds per acre. The manures used and the yields obtained per acre in 1916 are shown in the accompanying table :—

1	2	3	4	5	6
Manures used per acre.	Cowdung 5·5 tons.	Cowdung 5·5 tons, rape cake 823 pounds.	Rape cake 823 pounds.	Bonemeal 823 pounds.	Cowdung 5·5 tons, bonemeal 823 pounds.
	Tons.	Tons.	Tons.	Tons.	Tons.
King of Potatoes	5·17	7·35	2·92	4·49	6·90
Magnum Bonum	3·94	6·56	2·77	4·56	5·82
Total ...	9·11	13·91	5·69	9·05	12·72
Average yield per acre ...	4·55	6·95	2·84	4·52	6·36

Bonemeal and rape cake were used, not because they were considered the most suitable for the potato crop but because they are practically the only manures, other than cowdung, which are known to the cultivators of the Khasi Hills.

From the yields obtained it would seem that under the conditions prevailing on the Upper Shillong Farm, while rape cake is more effective than bonemeal as a supplementary dressing with cowdung, yet when used alone, bonemeal gives much better results than the rape cake. These manures are again under experiment in the present season, and the results will appear in next year's report.

Potatoes for seed.

6. Six varieties of potatoes were grown during the present year for the purpose of seed, namely, King of Potatoes, Magnum Bonum, Up-to-Date, Windsor Castle, British Queen and Imperator. The crop was planted in March and has just been harvested. The total area planted was 7·4 acres as against 3·1 acres in 1916. The manures

used were, as in previous years, 5·5 tons of cowdung, and 823 pounds of rape cake per acre. The crop was sprayed once with Bordeaux mixture at the rate of 120 gallons per acre. The outturn was as follows :—

Variety.	Area, in acre.	Total yield.
1	2	3
		Tons.
King of Potatoes	2·35	7·08
Magnum Bonum	2·075	6·29
Up-to-Date	1·325	4·14
Windsor Castle	1·15	4·62
British Queen (1909)	·25	·74
Imperator	·25	1·03
Total	7·4	23·9

The average yield per acre amounted to a little over 3·2 tons against 5·5 tons in 1916.

The demand from the plains for seed potatoes grown on the Shillong Farm is extending rapidly. In order to meet this increased demand, the area under this crop has been extended as far as practicable with the quantity of cattle manure which is available. Even then there is insufficient supply for the requirements of both hills and plains districts. To still further increase the supply, arrangements were made in 1916 to cultivate an extra area of potatoes under the *jhum* system. In that year an area of 16½ acres was planted on the farm lands according to this system.

An agreement was made with Khasi cultivators to carry out this work. The terms were that the farm should provide the land and the seed, and that the cultivators should do the work, and return to the farm one and a half times the seed supplied. The cultivators also undertake to sell at bazaar rates whatever additional quantity might be required. In 1916, the farm supplied for this purpose 6·65 tons and in return received 10·78 tons. This included ·8 ton received as payment for the work of spraying the crop with Bordeaux mixture, which was done by the farm workers.

In the present year 10¼ acres are being cultivated under a similar agreement. The farm supplied 2·92 tons and it is expected that the return will be about 4·7 tons. The total quantity of potatoes available for disposal last year (1916) was 56·13 tons made up as follows :—

	Tons.	
Farm-grown crop, taking summer and winter crop together.	30·75	
Jhum grown	10·78	
Purchased from *jhum* cultivators	14·60	
Total		56·13

This quantity was disposed of as follows :—

Sold to Khasi cultivators	7·56	
Supplied to Gauhati Seed Depôt and other places in the province through the Agricultural officers.	21·73	
Sold direct from the farm to officials and private individuals outside Khasi Hills.	2·16	
Total quantity supplied for seed ...		31·45
Used on the farm and the *jhum* area for planting ...	20·	
Feed of farm stock	·54	
Dryage and rottage	4·14	
		24·68
Total		56·13

The price charged to Khasi cultivators for seed potatoes supplied was the market price for table potatoes for the time being, and varied last year between Rs. 2-8 and Rs. 2-12 per maund, against a slightly higher rate charged in the previous year.

While in storage on the farm the potatoes kept rather better than in the previous year. A small quantity of damaged potatoes and of potatoes which were unsuitable for seed were fed to the farm stock.

The seed potatoes sold consisted of 9·32 tons of King of Potatoes, 13·76 tons of Magnum Bonum, 4·73 tons Up-to-Date, 3·52 tons of Windsor Castle and the balance of the minor varieties.

Warping of rice land.

7. Experience during the past few years showed that some land which had been reclaimed in 1912-13 from a marsh for the purpose of rice cultivation was still unfit for the crop. The sterility of the soil was believed to be due to the fact, that the upper

layer was mostly composed of tough grass roots, which were slow to decay, and it contained very little of what might be called real soil. An experiment was made during the year 1915, to see if the land could be brought into a fit condition for growing rice by a process known as "warping," which consists in covering the land with a layer of soil deposited from water. This method is used by the Khasis for renovating worn-out rice land.

One acre of land out of the area reclaimed in 1912-13 was taken for the purpose of this experiment. A slow current of water laden with soil thrown into it at a higher level, was made to flow over the land. By shifting the current from place to place the whole area was gradually covered with a layer of silt about 3" thick. It was a rather costly operation, the total cost being no less than Rs. 128 for the one acre of land.

The land which is divided into 10 equal plots of $\frac{1}{10}$th of an acre each, was sown with wet rice in the spring of 1915, and alongside it some similar but untreated land was sown at the same time for comparison. A better crop was obtained than in the previous year, although it was still a light one. The yield on the warped land was 831 pounds of grain and 1,600 pounds of straw per acre, while on the unwarped land the rates were 730 pounds of grain and 1,405 pounds of straw. This increased yield of 101 pounds of grain and 195 pounds of straw was a very small one considering the expenditure incurred. As it was expected that a greater difference might be shown in the following year, the experiment was continued. A heavy rainfall set in when the seed was germinating and caused an extra flow of water which damaged part of the area, and so rendered the experiment unfit for comparison. The experiment is being continued in the present year.

New crops.

8. *Buck wheat.*—This crop has been recently introduced into the district by Nepalese settlers, and although the returns have not been very large, it seems to have possibilities on the Khasi Hills, as the cost of cultivation is so small. When the seed is sown immediately after the potatoes have been dug, no extra cultivation is required. On the farm this course was followed satisfactorily for the first two years of the experiment. In 1915, the crop grew very well until the frosts set in, which unfortunately was rather early in the season. Afterwards little growth was made and the yield was disappointing. The 1916 crop met with a similar fate and was not worth harvesting. In the present year precautions are being taken to sow early, and it is hoped that this crop may be fortunate enough to escape the frosts.

Rhubarb.

This crop was first planted in 1912, on a plot of land about $\frac{1}{10}$th of an acre in extent. A further plot of $\frac{1}{20}$th of an acre was planted in 1915. The land was manured with cowdung in the winter of 1916-17, at the rate of 11 tons per acre.

The plants grew vigorously and a total of 377 pounds of stalks was sold, realising Rs. 45-14.

The plants are continuing to grow well.

Strawberries.

In September 1916 an additional plot of $\frac{1}{20}$th acre was planted with two varieties of strawberries obtained from the fruit garden, Shillong. These plants have grown well.

The plot of $\frac{1}{20}$th acre planted in 1914 was manured last winter with cowdung and bonemeal at the rate of 11 tons and 247 pounds, respectively.

These plants are growing well, but owing to the severe spring drought, they flowered late in the season and the crop was a short one.

About ten pounds of fruit have been picked and sold during the year, and the return therefrom was Rs. 13.

Other fruits.

A few of the trees on the farm bore fruits. These were sold and realised the following sums :—

	Rs.	a.	p.
Apples	32	7	6
Peaches	5	13	0
Chestnuts	6	12	0

Fodder crops.

9. The following fodder crops were grown during the year :—

Names of crops.	Area sown.	Cost of cultivation.	Outturn of green fodder.
	Acres.	Rs. a. p.	Tons.
... ...	9·1	266 5 10	32·53
Maize	3·84	155 6 4	2·75
Job's tears	8 approximate.	.....	17·0
Jhum area			
Total	20·85	461 12 2	52·28

The maize crop gave a fair yield. Job's tears did well on the *jhum* area, but the farm crop was poor.

The whole of this fodder (52·77 tons) was made into ensilage. From this quantity of green material 35·59 tons or 67 per cent. was recovered as ensilage of good quality.

The total cost of silage was Rs. 688-2, made up of cost of cultivation Rs. 421-12-2, cost of carrying the fodder, chopping, and packing in the Silo Rs. 266-5-10.

The proportion of loss through decay around the sides of the pit in which the ensilage was made, was not very heavy, although greater than in the previous year. The cost per ton of silage was Rs. 19-6 as compared with Rs. 26-8 in the previous year. The lower cost this year was the outcome of the much larger quantity of crop dealt with.

Raishan (*Paspalum sanguinale*) has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. *Raishan* was grown on an area of 9·3 acres and the produce was made into hay and fed to the cattle during the winter months.

A total amount of 16·18 tons of hay was fed during the year. The cost was Rs. 551, or a little over Rs. 34 per ton of hay.

The quality of this fodder was good, and all was eaten by the cattle.

Cattle breeding.

10. The following table shows the number of cattle in the herd on 30th June 1917 :—

Description.	Montgomery.	Patna (P).	Bhutia B).	P × B.	P × B P.	P × B × P × P.	P × B × P × P × P.	P × Khasia (K).	Total on 30th June 1917.	Total on 30th June 1916.	Total on 30th June 1915.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
Breeding bulls ...	1	...	...	...	...	...	...	...	1	2	2	
Bulls (3 years and above) ...	...	1	...	...	...	...	...	2	3	4	3	Are being used as plough cattle.
„ (2 to 3 years) ...	...	2	...	1	3	1	...	...	7	3	5	
„ (1 to 2 years) ...	...	3	...	...	1	4	...	...	8	9	2	

Description.	Montgomery.	Patna (P).	Bhutia (B).	P × B.	P × B × P.	P × B × P × P.	P × B × P × P × P.	P × Khasi (K).	Total on 30th June 1917.	Total on 30th June 1916.	Total on 30th June 1915.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
Bulls (under 1 year) ...	...	5	...	...	...	1	...	...	6	8	10	
Heifers (2 to 3 years) ...	...	3	...	...	4	3	...	...	10	9	5	
„ (above 3 years) ...	...	1	...	...	...	...	...	...	1	...	...	
„ (1 to 2 years) ...	...	9	...	1	2	...	...	...	12	6	9	
„ (under 1 year) ...	...	3	...	1	1	...	4	...	9	12	7	
Cows	...	13	1	6	3	6	...	...	29	25	21	
Total on 30th June 1917	1	40	1	9	14	15	4	...	86	...	...	
Total on 30th June 1916	...	38	1	9	14	13	1	2	...	78	...	
Total on 30th June 1915	...	31	1	9	12	9	...	2	...	...	64	

In addition to the above, there were three Hindustani and 8 Khasi bullocks. The total number of cattle was, therefore, 97 against 88 on the corresponding date of last year.

During the year under report the following cattle were bought locally :—

One Montgomery bull was purchased for breeding purposes from the Roman Catholic Mission at a price of Rs. 180.

Two Khasi plough bullocks were purchased to replace a pair that had become useless owing to advanced age.

The demand for bulls bred at the farm still far exceeds the supply. During the past year 8 bulls were sold, *viz.*, two breeding bulls sold because they had become useless owing to old age, three young Patna bulls sold to cultivators in the Khasi Hills,

one Patna bull and one Patna × Bhutia × Patna bull sold to tea-garden Managers in the Surma Valley, one Patna × Bhutia bull sold to a Khasi cultivator.

The total yield of milk during the year amounted to 2,585 gallons, out of which about 84 gallons were fed to calves, and the remainder was sold at the rate of 14 lbs. for the rupee.

The cost of maintenance of the herd amounted to Rs. 3,712-9-8 against Rs. 4,485-4-9 in the previous year. The income from the sale of milk amounted to Rs. 1,854-5-6 against Rs. 1,949-8-6, and the value of the cattle sold to Rs. 327 against Rs. 180 in the previous year.

The half English Patna cattle and the progony of their cross with Khasi and Bhutia breeds have proved remarkably well adapted to the climate of the Khasi Hills. In respect of milking capacity, these cattle stand head and shoulders above any cattle on this side of India.

After many years of work, we have got together a fine stock of milk cattle, the like of which is not to be seen within many hundred miles of Shillong, and which promises to improve further by selection and crossing. It would be a comparatively easy matter to increase the herd so as to make it possible for us to sell cows and heifers to the public. There is a great demand for female stock bred at Upper Shillong, but we cannot afford to sell any at present. Some of our cows might easily fetch Rs. 200 or more if offered for sale.

The cost of maintaining the herd is still high. It has been reduced considerably in recent years, and it would seem that still further reduction is possible. It might be possible to reduce the expenditure by separating the cows from the rest of the herd and maintaining them purely with a view to profit.

That the Upper Shillong cattle are being more and more appreciated is evident from the growing desire of cow-owners in the Shillong station for the services of bulls bred on the farm.

The former breeding bulls were too old and had to be sold off. The proposal to purchase an Ayrshire bull had to be dropped owing to the difficulties of importing an animal from abroad at the present time.

The present herd of Patna cattle is far superior to the cattle of the province, and it would undoubtedly be advisable to maintain this breed. Several attempts have been made to obtain young bulls from the Patna district, but owing to indiscriminate breeding in that district in recent years, it has been so far found impossible to procure bulls of the desired type.

As neither Ayrshire nor Patna bulls were obtainable, the above mentioned Montgomery bull was purchased and for so far has proved satisfactory.

Distribution of seed and plants.

11. The following were the seeds and plants supplied to agriculturists during the year :—

	Tons.	Number.
Seed potatoes	31·47	...
Rhubarb roots	...	58
Strawberry plants	...	74
Pear grafts	...	110
Fig cutting	...	10
Oil cake for manure	·45	...

Establishment.

12. Mr. Herrick Sing continued in the position of Farm Manager during the year.

U Bendramoney occupied the position of Farm clerk throughout the year.

Of the three apprentices who were in training at the beginning of the year, Paschalis Hoverwell has since been appointed Agricultural Demonstrator in the North Cachar Hills. Rodie Singh resigned his apprenticeship. H. W. Momin who was specially sent from the Garo Hills has been appointed Demonstrator for his native district. Two new apprentices were appointed to the vacant apprenticeships, *viz.*, Gloshon Singh appointed on 26th July 1916, and Sedro Singh appointed on 1st November 1916. In addition to these two apprentices, two Garo candidate apprentices are being entertained. These young men work with the labourers and are paid at the ordinary rates.

Receipts and Expenditure.

13. The total receipts, including the value of seed potatoes for demonstration purposes in the Assam and Surma Valleys, were Rs. 4,516-12-6 against Rs. 5,656-14-11 in the previous year.

The sale of milk produced Rs. 1,854-15-6, the sale of cattle Rs. 327, while potatoes sold direct from the farm realised Rs. 867-2, and in addition, potatoes to the value of Rs. 1,107-13 were supplied for demonstration purposes throughout the province.

The total expenditure for the year amounted to Rs. 14,014-7-9 against Rs. 12,299-5-4 in the previous year. The increase in expenditure was due to two items, *viz.*, the purchase of cattle and a sum of Rs. 1,293 spent on erecting a permanent wire fence.

SHILLONG:
The 28th August 1917.

J. W. McKAY,
Deputy Director of Agriculture, Surma Valley.

ANNUAL REPORT OF THE FRUIT EXPERIMENT STATION, SHILLONG, FOR THE YEAR ENDING THE 30TH JUNE 1917.

1. *Introductory.*—The Fruit Station commenced work in October 1912—Planting was commenced in the spring of 1913. The land is situated on the south side of the Jowai road, distant about a mile from Shillong. The elevation is about 5,100 feet. The total area of the grant is 57·41 acres, of which about 25 acres is suitable for fruit growing—23 acres have been planted.

2. *Lower garden.*—No extension to this block has been made since 1913-14 and the planted area remains at 4¼ acres in grounds of 6·13 acres—the fruit trees are planted 15′×15′ diagonally. The soil of this block varies from light sandy loam lying above stone to heavier loam of good depth. The trees on the heavier loam continue to improve in growth and yield: the following varieties on this soil have so far yielded best :—James Grieve, Kerry Pippin, Sturmer Pippin, Bens Red, Bismarck, Peasgood's Nonsuch, Alfriston, Red Victoria : the following varieties have yielded sparsely :—Red Juneating, Warners King, Hounslow Wonder, Cox's Orange Pippin, Hector MacDonald, Coe's Golden Drop, Scarlet Nonpareil, Golden Reinette, Devonshire Quarrenden, Yellow Ingestre, Ardcairn Russet, William Crump. On the lighter soil only the stronger growing varieties of apples planted have succeeded, *viz.*—Encore, Bramley's Seedling, Crimson Bramley, Newton Wonder, Lady Sudeley, Norfolk Beauty, Peasgood's Nonsuch, Alfriston, Lane's Prince Albert, Allington Pippin, Kerry Pippin, Potts Seedling, Rymer. The varieties Sanspareil, Duke of Devonshire, Allen's Everlasting, Beauty of Bath, Ribston Pippin, have been removed to a Nursery on stronger soil. In their place the varieties Bismarck, Worcester Pearmain, Grenadier, Star of Devon, Upton Pyne, Rev. W. Wilks, have been planted.

The Pear trees are improving in growth, the following varieties flowered, and set fruit :—William bon Chretien, Fondant Thirriot, Fondante d' Automne, Fertility, St. Swithins, Roosevelt, Marguerite Marillat, Doyenne du Comice. Of these varieties, as far as can be judged now, Fertility should be a good market pear —St. Swithins is an early variety, but is small and a poor keeper.

The Fondante d' Automne upright trained trees are bearing well—a delicious melting pear: Marguerite Marillat is a large and handsome pear. The William bon Chretien and Marguerite Marillat trees show a week growth on the Quince stock, but may improve. The Fondante Thirriot is a large pear of good flavour, and promises well.

The Cherry trees have grown well: the varieties "Kentish" and "Morello" were the only ones to bear fruit. The Duke of York, Peregrine, and Kestrel, Peach trees bore good well coloured fruit.

The Plum trees planted on the lighter soil have not succeeded. Deniston's Superb, Belle de Louvain, Belgian Purple have been left for further trial, and the others have been removed to a Nursery on stronger soil—Shepherd's Bullace, and Merryweather's Damson have grown well on the heavier loam, and show great promise of yielding good crops. Merryweather's Damson is all the raisers Messrs. Merryweather & Sons claim for it; it could readily be mistaken for a late plum until tasted. Although the size is so much above that of the largest Damson grown, the true flavour of the Damson is retained. The Giant Himalaya Berry of California and the Blowers are the best of the varieties of Blackberries; and the King's Acre Berry the best of the Hybrid Berries. The fruit of the Hawthorn-leaved Berry (Rubus Cratœgifolius) is worthless and this variety will be discarded. The Raspberries are not a success; they bear the year after they are planted, but the growth of the new canes in following years is weak. The varieties, the Devon and Royal, transplanted last year to the upper garden show no improvement. The autumn fruiting variety November Abundance is the only variety that shows any promise of succeeding. Royal Sovereign, Laxton Cropper, and Givons Late Prolific, Strawberries yielded good crops. Gooseberries have failed, and are not suitable for the climate. Red and white currants show no promise of succeeding: Black Currants may succeed on a suitable site: the trees from this garden have been transplanted to shady sites in the Upper garden. The land has been well cultivated during the year.—The lighter soil, when deeply dug in the cold weather, was found to be infested with the Cockchafer grub which have attacked the surface roots of the majority of the Apple and Plum trees: the soil round all of the trees was removed and the grubs killed. The greater percentage of the Apples gathered have been worm free, but Calyx spraying and later applications during the summer will have to be done to ensure good crops of sound fruit.

3. *Upper garden.*—The area planted is 18¾ acres, of which 10½ acres was planted in 1914, 2 acres in 1915, ½ an acre in 1916, 5¼ acres in 1917. It is divided into 6 blocks, *viz.* :—

Top block.—Area 1¾ acres, planted in 1914 with Bush Apple trees 15′×15′ diagonally.

North block.—Area 1½ acres, planted in 1914 with Standard Apple trees 34′×34′ diagonally, interplanted with Bush Apple trees 17′×17′.

South block.—Area 4¼ acres, planted with Standard Apple trees 30′×30′ diagonally, partly interplanted with Bush Apple, Pear, and Almond trees 15′×15′—3/4 acre planted in 1914, 1/4 acre planted in 1915, 1/2 acre planted in 1916, 2¾ acres planted in 1917.

East block.—Area 7 acres, planted with Standard Apple trees 34′×34′ diagonally, interplanted with Bush Apple trees 17′×17′—5½ acres planted in 1914, 1½ acres planted in 1915.

East block extension.—Area 2½ acres, planted in 1917 with Standard Apple trees 30′×30′ diagonally, interplanted with Bush Apple trees 15′×15′.

West block.—Area 1¼ acres, planted with Standard Pear trees 25′×25′ diagonally, interplanted with Bush Pear trees 12′-6″×12′-6″—1 acre planted in 1914, ¼ acre planted in 1915.

In the south block only 2 acres of the 4¼ acres has been interplanted with Bush trees.

The soil of the Upper garden is a good loam of about 12 inches depth lying on a reddish sub-soil. Small plots have a hard pan sub-soil about 2½ feet from the surface. The whole of the planted area has been terraced with stone and banks. It has successfully prevented the denudation of the soil by rainfall.

Five hundred Paradise stock and 1,100 Kashmir Crab stock for Apple grafting are planted 3 feet apart in rows between the trees in the East block. Similarly, 1,500 Devonshire Crab stock have been planted in the North and Top blocks; and 1,000 Quince stock and 800 Pear stock for Pear grafting in the West block.

The following Apples and Pears were grafted successfully in July and August 1916 on stock in the East and West blocks—47 Fertility Pears and 420 Apples of the following varieties :—40 Bismarck, 73 James Grieve, 52 Kerry Pippin, 15 Lane's Prince Albert, 17 Rev. W. Wilks, 4 Stirling Castle, 7 Red Victoria, 24 Crimson Bramley's Seedling, 20 Bramley's Seedling, 40 Alfriston, 25 Bens Red, 48 Rival, 55 Domino. The following varieties of

Apples in the Upper garden have so far yielded best of the Bush trees:—James Grieve, Lane's Prince Albert, Upton Pyne, Stirling Castle, Bismarck, Rev. W. Wilks, Domino, Rival, Baumann's Reinette, Browndees Russet, Red Victoria, Sturmer Pippin, Emneth Early, William's Favourite, Kerry Pippin, Peasgood's Nonsuch, Lady Sudeley, Mr. Gladstone, Encore, Bramley's Seedling, Newton Wonder, Charles Ross, Crimson Bramley's Seedling, Bens Red, Alfriston, Cardinal. The following varieties have yielded sparsely—Boston Russet, Claygate Pearmain, Mannington Pearmain, Red Juneating, Flower of Kent, Barnack Beauty, Norfolk Beauty, Christmas Pearmain, Royal Snow, Houblon, Wellington, Devon Queen, Renown, Rymer, Thomas Rivers, Grenadier, Potts Seedling, Wadhurst Pippin, Ecklinville Seedling, Scarlet Nonpareil, Beauty of Bedford, Reinette doree de Heusgen, Ardcairn Russet, Allington Pippin, William Crump, Herrings Pippin, Beauty of Bath, Golden Spire, Irish Peach.

The following varieties have not yet borne fruit—Egremont Russet, Annie Elizabeth, Lord Hindlip, Blenheim Orange, Winter Quarening of Kent, Pineapple Russet, Edward VII, Coronation, Wealthy, Feltham Beauty, Yorkshire Beauty, Kings Acre Pippin, Golden Russet, Roundway Magnum Bonum, Warners King, Hounslow Wonder, Hector MacDonald, Court Pendu Plat, Gascognes Scarlet, Spitzenberg, Braddick's Nonpareil, White Nonpareil, Pitmaston Pineapple, Langley Pippin, Wagener, Lord Burghley, St. Everard, Coe's Golden drop, Fearn's Pippin, Spring Ribston Pippin, Rosemary Russet, Early Peach, Newtown Pippin, American Mother. Only a few of the Pear trees flowered or set fruit, the variety "Princess" flowered profusely, but one tree only bore fruit. It is probably self sterile and other varieties flowering at the same time will have to be planted near it: it is a seedling from Louise Bonne of Jersey, and in size and colour it resembles the parent, large, flesh melting, flavour very good. The other varieties that set fruit were Marguerite Marillat, William bon Chretien, Fertility; Doyenne d' Ete. The latter is a small very early pear. None of the English Plum trees did well; the American varieties—Shiro, Gold, Omaha have grown well, and it is hoped will fruit next year. None of the Orange trees have yet borne fruit. The whole area of the upper garden has been well cultivated and the trees have put on very satisfactory growth—Kerry Pippin and James Grieve have yielded best of the dessert varieties of Apples; and Rev. W. Wilks, Bismarck and Alfriston, of the culinary varieties. Three thousand Royal Sovereign Strawberry runners were planted out in the East block in October, and have grown well.

5¼ acres was added to the planted area this year. The American varieties of Apples, Delicious, King David, Black Ben, Grimes Golden, planted in the South block should succeed, judging from the growth of the trees in the Nurseries. The whole of the planted area has been fenced with Page's wire fencing 4'-10" high.

The following trees are in Nurseries for future planting :—

Description.	South block, 1915 and 1916, trees.	South block, 1917, trees.	East block, 1915, trees from Kashmir.	East block, 1915 and 1916, trees.	Total.
1	2	3	4	5	6
Standard Apple trees ...	175	18	210	260	663
Bush „ „ ...	...	...	...	..	...
Standard Pear „ ...	80	12	41	...	133
Bush „ „ ...	...	...	....	...	...
Cherry „ ...	...	...	18	...	18
Apricot „ ...	...	...	7	...	7
Walnut „ ...	...	...	4	...	4
Plum „ ...	11	6	4	98	119
Almond „ ...	...	...	20	...	20
Sweet Chesnut „ ...	6	...	...	...	6
Pecan Nut „ ...	9	...	...	...	9
Black Currant „ ...	24	...	...	...	24
Red „ „ ...	5	...	...	...	5
White „ „ ...	5	...	...	...	5
Gooseberry „ ...	4	...	...	...	4

The establishment consists of an Overseer on a monthly salary of Rs. 25, 2 Khasi Apprentices, and 8 Khasi *malis* on a monthly salary of Rs. 15 each. All have worked well and take great interest in their work.

4. *Varieties planted.*—The following statement shows the number and varieties of fruit trees planted :—

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1918. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	James Grieve ...	59	74	146	58	...	44	381	Bush.
	Boston Russet ...	...	2	12	...	...	...	14	
	Bens Red ...	...	...	10	10	...	9	29	
	Alfriston ...	...	...	30	...	...	8	38	
	Egremont Russet ...	10	...	...	8	1	...	19	
	Annie Elizabeth ...	...	...	20	...	...	...	20	
	Claygate Pearmain ...	8	...	...	10	...	...	18	
	Lord Hindlip ...	...	...	10	...	...	...	10	
	Mannington Pearmain	6	...	...	8	2	4	20	
	Winter Queening of Kent.	...	...	10	...	...	...	10	
	Pineapple Russet ...	...	...	...	9	...	...	9	
	Edward VII ...	...	...	9	...	...	...	9	
	Red Juneating ...	6	...	...	2	...	10	18	
	Flower of Kent ...	...	...	8	...	...	...	8	
	Cornish Pine ...	2	...	11	...	...	1	14	
	Tower of Glamis ...	...	...	...	...	6	...	6	
	Winter Banana ...	...	...	...	...	3	...	3	
	Wolf River ...	...	...	...	...	3	...	3	
	Chelmsford Wonder ...	...	...	...	...	6	...	6	
	Byford Wonder ...	...	...	...	...	10	...	10	
	Ruddy	...	...	...	...	6	...	6	
	Ormead Pearmain ...	...	...	...	...	6	...	6	
	Hambedon deux ans	...	...	...	...	5	...	5	
	Belle de Pontoise ...	...	...	...	...	5	...	5	
	Barnack Beauty ...	...	...	...	6	8	5	19	
	Coronation ...	...	...	6	4	...	5	15	
	Wealthy	...	...	...	4	...	6	10	
	Feltham Beauty ...	...	...	10	...	...	...	10	
	Norfolk Beauty ...	8	...	...	10	...	10	28	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees	Christmas Pearmain	...	...	10	...	...	...	10	Bush.
	Yorkshire Beauty	5	...	...	1	...	...	6	
	Kings Acre Pippin	...	...	6	...	...	...	6	
	Crimson Bramley	15	...	18	...	...	5	38	
	Royal Snow	...	...	10	...	...	...	10	
	Bramley's Seedling	15	...	15	...	...	15	45	
	Kings of Tompkins County.	1	...	7	2	...	...	10	
	Houblon	...	...	6	...	...	...	6	
	Roundway Magnum Bonum.	6	...	...	...	...	2	8	
	Wellington	...	...	5	...	...	...	5	
	Lane's Prince Albert	14	2	19	...	10	11	56	
	Upton Pyne	1	3	6	...	...	...	10	
	Devon Queen	4	1	2	...	3	...	10	
	Renown	...	4	...	...	6	...	10	
	Stirling Castle	10	...	10	...	...	...	20	
	Golden Russet	...	...	6	...	...	...	6	
	Charles Ross	10	...	10	...	11	...	31	
	Bismarck	...	...	17	8	...	19	44	
	Rymer	6	...	...	...	...	...	6	
	Warner's King	...	...	...	...	...	11	11	
	Thomas Rivers	10	...	...	...	...	...	10	
	Grenadier	...	2	17	...	...	3	22	
	Rev. W. Wilks	19	...	6	...	...	6	31	
	Hounslow Wonder	...	1	20	...	...	6	27	
	Newton Wonder	15	...	21	...	...	16	52	
	Red Victoria	...	4	11	...	3	10	28	
	Potts' Seedling	4	...	5	...	...	10	19	
	Hector McDonald	...	...	20	...	...	10	30	
	Emperor Alexander	...	9	1	...	...	...	10	
	Sandringham	...	...	...	...	6	...	6	
	Reugemont	...	...	...	...	6	...	6	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Hamblings Seedling...	...	...	...	...	6	...	6	Bush.
	Gabalva	...	...	...	...	6	...	6	
	Baron Wolsely ...	...	...	...	...	6	...	6	
	Loddington Seedling	...	...	...	...	6	...	6	
	Parroquet ...	...	...	...	...	6	...	6	
	Domino	13	...	...	...	...	...	13	
	Rival	...	...	16	...	12	...	28	
	Wadhurst Pippin ...	10	...	...	...	...	...	10	
	Court Pendu Plat ...	6	...	6	...	...	...	12	
	Ecklinville Seedling ...	4	...	4	...	...	...	8	
	Early Red Margaret ...	...	...	10	...	...	...	10	
	Gascoyne's Scarlet ...	4	...	5	...	...	...	9	
	Spitzenberg ...	...	...	6	...	...	...	6	
	Braddicks Nonpariel...	5	...	...	...	...	...	5	
	White Nonpariel ...	10	...	...	...	...	...	10	
	Baumann's Reinette...	6	7	8	...	4	...	25	
	Pitmaston Pineapple	10	...	...	...	...	...	10	
	Brownlee's Russet ...	10	...	...	...	...	...	10	
	Sturmer Pippin ...	5	6	16	...	...	20	47	
	Cardinal	...	...	9	1	...	...	10	
	Emneth Early ...	...	3	16	...	8	...	27	
	Langley Pippin ...	...	...	10	...	...	...	10	
	Wagener	...	...	9	...	...	...	9	
	Williams' Favourite...	10	...	...	...	...	...	10	
	Scarlet Nonpariel ...	...	...	10	...	...	12	22	
	Lord Burghley ...	1	...	...	...	4	3	6	
	St. Everard ...	...	6	...	...	4	...	10	
	Beauty of Bedford ...	...	3	...	...	7	...	10	
	Reinette doree de Heusgen.	10	...	...	...	...	...	10	
	Coe's Golden Drop ...	...	...	...	...	...	6	6	
	Cox's Orange Pippin...	...	...	...	...	...	23	23	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1918. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees	Kerry Pippin ...	...	10	16	...	...	10	36	Bush.
	Golden Reinette ...	...	...	...	...	...	6	6	
	Peasgood's Nonsuch...	...	...	26	...	...	14	40	
	Fearn's Pippin ...	...	...	12	...	...	6	18	
	Lady Sudeley ...	...	...	20	...	...	10	30	
	Devonshire Quarrenden	...	...	...	...	...	17	17	
	May Queen ...	...	10	...	...	...	...	10	
	Royal Jubilee ...	...	8	...	...	...	...	8	
	Missing Link ...	...	1	...	...	...	...	1	
	Roseberry ...	...	1	...	...	...	...	1	
	Crawley Beauty ...	...	1	...	...	...	...	1	
	Mrs. Phillimore ...	...	...	...	...	6	...	6	
	Lord Grosvenor ...	...	...	...	...	6	...	6	
	Blue Pearmain ...	...	...	...	...	4	...	4	
	Jefferson ...	...	...	...	...	7	...	7	
	Star of Devon ...	...	...	...	...	20	6	26	
	Yellow Ingestre ...	...	...	...	...	...	6	6	
	Upton Pyne ...	...	...	...	...	25	6	31	
	Ardcairn Russet ...	...	7	6	1	11	5	30	
	Allington Pippin ...	...	16	5	...	...	4	25	
	William Crump ...	...	8	19	...	12	6	45	
	Worcester Pearmain...	...	...	...	...	...	6	6	
	Herring's Pippin ...	4	6	3	...	52	1	66	
	Beauty of Bath ...	...	1	5	...	...	1	7	
	Ellison Orange ...	...	...	...	...	16	1	17	
	Ribston Pippin ...	...	...	...	...	...	6	6	
	Charles Eyre ...	...	...	3	...	10	7	20	
	Syke House Russet ...	...	...	...	...	...	6	6	
	Spring Ribston Pippin	...	...	8	...	...	...	8	
	Mr. Gladstone ...	...	...	6	...	...	5	11	
	Golden Spire ...	...	14	...	...	9	...	23	
	Rosemary Russet ...	...	...	6	...	...	6	12	

Species of fruit trees.	Variety	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1918. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
	Early Peach ...	...	10	...	...	...	...	10	Bush.
	Newtown Pippin ...	...	2	8	...	...	6	16	
	American Mother ...	...	9	...	...	...	...	9	
	Encore	...	...	18	...	...	4	22	
	Irish Peach ...	...	6	...	...	...	...	6	
	Lord Stradbroke ...	...	...	...	...	6	...	6	
	Total ...	342	137	816	142	359	484	2 330	
	Encore	...	6	...	...	...	...	6	Standards.
	Crimson Bramley ...	...	5	4	10	...	...	19	
	Rymer	...	...	...	...	...	8	8	
	Bramley's Seedling ...	...	...	8	12	...	...	20	
	Court of Wick ...	...	...	6	...	...	...	6	
	Irish Peach ...	...	...	...	6	...	...	6	
Apple trees ...	Northern Greening ...	...	...	...	...	...	8	8	
	Norfolk Beefing ...	...	...	...	6	...	...	6	
	Newton Wonder ...	...	4	21	...	...	...	25	
	Stirling Castle ...	...	...	5	1	...	5	11	
	Allington Pippin ...	...	...	...	...	...	4	4	
	Annie Elizabeth ...	...	...	...	...	9	...	9	
	Ellison's Orange ...	...	...	...	...	6	...	6	
	Chelmsford Wonder...	...	...	...	...	6	...	6	
	Lord Grosvenor ...	...	...	...	...	7	...	7	
	Christmas Pearmain...	...	...	...	...	10	...	10	
	Baldwin	...	1	...	...	...	...	1	
	Duchess of Oldenburg	...	...	6	...	...	...	6	
	Norfolk Beaver ...	...	...	5	1	...	...	6	
	King of Tompkins County.	...	...	6	...	...	...	6	
	Emperor Alexander ...	...	...	...	6	...	...	6	
	James Grieve ...	...	3	18	...	...	...	21	
	Cox's Pomona ...	...	...	2	4	...	...	6	
	Small's Admirable ...	...	...	6	...	...	...	6	
	New Hawthorden ...	...	...	5	...	...	...	5	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Delicious (Starks)	...	50	12	...	...	...	62	Standards.
	King David ,,	...	26	12	...	...	...	38	
	York Imperial ,,	...	...	6	...	...	...	6	
	Paragon Winesap (Starks).	...	...	5	...	...	...	5	
	Jonathan (Starks)	...	2	6	...	...	...	8	
	Black Ben (,,)	...	20	5	...	...	...	25	
	Stayman Winesap (Starks).	...	...	6	...	...	...	6	
	Senator (Starks)	...	1	5	...	...	...	6	
	Grimes Golden (Starks)	...	12	5	...	...	...	17	
	Summer Champion (Starks).	...	2	...	...	...	...	2	
	Mother Starks)	...	...	6	...	...	...	6	
	Emneth Early	...	...	10	...	...	...	10	
	Baumann's Reinette	...	...	10	...	...	...	10	
	Grenadier	...	...	8	...	...	...	8	
	Cox's Orange Pippin	...	...	15	...	...	...	15	
	Blenheim Orange	...	3	9	...	...	...	12	
	Calville Blanc	...	...	6	...	...	...	6	
	Norfolk Beauty	...	15	13	1	...	1	30	
	Reinette du Canada	...	6	...	...	...	...	6	
	Winter Greening	...	8	...	...	...	...	8	
	Rev. W. Wilks	...	1	...	...	29	7	37	
	Lord Burghley	...	6	...	...	...	...	6	
	Lady Henniker	...	4	6	...	...	...	10	
	Golden Spire	...	4	4	...	...	...	8	
	Bismarck	...	4	6	...	...	...	10	
	Calville Rouge d'hiver	...	...	...	...	1	...	1	
	Charles Ross	...	3	3	...	4	...	9	
	Lord Derby	...	...	...	...	...	8	8	
	Barnack Beauty	...	...	...	...	6	4	10	
	Herrings Pippin	...	3	...	...	16	...	19	
	Rival	...	2	...	...	6	...	8	
	Star of Devon	...	...	...	...	4	...	4	
	William Crump	...	...	...	...	5	...	5	
	Upton Pyne	...	...	...	...	15	...	15	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Early Melon (Starks)...	...	...	4	...	...	...	4	Standards.
	Wealthy („)...	...	...	4	...	...	...	4	
	Wilson's Red Juno (Starks).	...	...	6	...	...	...	6	
	Liveland Raspberry (Starks).	...	...	6	...	...	...	6	
	Worcester Pearmain ...	...	...	...	...	...	4	4	
	Total ...	...	191	269	47	124	49	680	
	Blenheim Orange ...	...	...	2	11	...	...	13	Horizontal trained.
	James Grieve ...	...	...	...	...	...	4	4	
	Feltham Beauty ...	...	...	2	3	...	...	5	
	Lady Sudeley ...	2	...	...	...	...	3	5	
	Herring's Pippin ...	...	...	2	1	...	2	5	
	Gascoyne's Scarlet ...	3	...	...	...	...	...	3	
	Charles Ross ...	3	...	...	...	...	...	3	
	Brownlees Russet ...	3	...	...	...	...	2	5	
	Baumann's Reinette...	3	...	...	...	...	...	3	
	Beauty of Bath ...	...	...	...	...	...	5	5	
	Sturmer Pippin ...	6	...	...	...	...	...	6	
	Cox's Orange Pippin...	...	...	...	...	...	1	1	
	Cox's Pomona ...	1	...	...	...	...	3	4	
	King of the Pippins ...	...	...	3	...	...	2	5	
	Kerry Pippin ...	...	...	...	...	...	1	1	
	Claygate Pearmain ...	...	...	...	...	...	1	1	
	King of Tompkins County.	...	...	3	...	...	...	3	
	Sterling Castle ...	...	...	...	...	...	3	3	
	Total ...	21	...	12	15	...	27	75	
	Sturmer Pippin ...	...	...	...	3	...	...	3	Upright trained.
	Mannington Pearmain	...	...	...	3	...	...	3	
	Scarlet Golden Pippin	...	...	...	...	...	2	2	
	Washington ...	2	...	2	2	...	...	6	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees	Allington Pippin ...	...	...	...	...	...	2	2	Upright trained.
	Golden Spire ...	...	...	1	...	...	...	1	
	Beauty of Bath ...	...	...	...	...	...	2	2	
	Adams Pearmain ...	2	...	...	1	...	...	3	
	James Grieve ...	....	...	...	...	...	2	2	
	King of the Pippins...	...	...	2	1	...	...	3	
	Barnack Beauty ...	...	...	...	...	...	2	2	
	King of Tompkins County.	...	...	...	6	...	...	6	
	Total ...	4	...	5	16	...	10	35	
	Charles Ross ...	...	...	6	...	...	...	6	Palmette Verrier trained.
	Rival	...	...	5	...	...	...	5	
	James Grieve ...	...	...	6	...	...	...	6	
	Blenheim Orange ...	...	...	6	...	...	...	6	
	Total ...	...	...	23	...	...	...	23	
	Baumann's Reinette...	4	...	...	...	...	...	4	Fan trained.
	Golden Spire ...	1	....	...	...	...	...	1	
	Total ...	5	...	...	...	...	...	5	
	Rival	...	...	3	...	...	...	3	Double Cordon.
	Total ...	...	...	3	...	...	...	3	
	Rival	...	...	3	...	...	...	3	Single Cordon.
	Total ...	...	...	3	...	...	...	3	

Species of fruit trees.	Variety.	Planted 1914-17.				Planted 1913.	Total number.	Description.
		Upper garden.						
		Top block.	West block.	South block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9
Pear trees.	Fertility	...	53	...	...	18	71	Bush and Pyramid.
	St. Swithins ...	...	...	...	...	10	10	
	Beurre Hardy ...	...	17	...	3	...	20	
	Red October ...	...	...	...	...	9	9	
	Beurre d'Anjou ...	...	6	...	...	...	6	
	Parrot	...	...	...	...	10	10	
	William's Bon Chretien.	...	1	...	...	...	13	
	Seedling Bergamot ...	...	...	...	...	6	6	
	Fondante Thirriot ...	..	10	...	...	10	20	
	Dr. Hogg	...	...	...	...	7	7	
	Triomphe de Vienne ...	..	6	...	...	...	6	
	Beacon	...	...	...	...	7	7	
	Beurre de Naghan ..	...	...	...	...	6	6	
	Charles Ernest ...	...	12	...	...	...	12	
	Roosevelt	...	...	...	...	6	6	
	Doyenne d'Ete ...	...	10	...	...	...	10	
	Blicking	...	...	...	...	6	6	
	Gansels Bergamot ...	...	6	...	...	...	6	
	Santa Claus ...	...	...	...	...	6	6	
	Josephine de Malines...	...	6	...	...	9	15	
	Precoce de Juillet ...	...	...	...	...	5	5	
	Dr. Jules Guyot ..	...	11	...	...	6	17	
	Madame Treyve ...	...	...	...	...	10	10	
	Durondeau ...	...	7	...	...	3	10	
	Hessle	...	5	...	1	13	19	
	Beurre d'Amanlis ...	...	12	...	...	10	22	
	Emile d'Heyst ...	...	5	...	...	10	15	
	Marie Benoist ...	...	6	...	...	...	6	
	Clapp's Favourite ...	...	5	...	...	10	15	
	Louise Bonne of Jersey.	...	2	...	...	...	2	
	President Barnbe ...	...	5	...	...	...	5	
	Thompson ...	...	5	...	...	...	5	
	Winter Nelis ...	...	4	...	...	...	4	
	Marguerite Marilliat...	...	6	...	...	...	6	
	Seckle	...	...	6	...	...	6	
	Beurre Fouquerny ...	...	...	6	...	...	6	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	West block.	South block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
	Directeur Hardy ...	...	...	5	...	...	5	Bush and Pyramid.
	Colmar d'Ete ...	...	6	6	...	...	12	
	Princess	...	6	6	...	...	12	
	Belle Julie ...	...	6	6	...	...	12	
	Doyenne du Comice ...	...	2	4	...	...	6	
	Total ...	...	232	39	4	177	452	
	Beurre Hardy ...	...	14	...	...	5	19	Single Cordon.
	Clapp's Favourite ...	...	10	...	...	...	10	
	Durondeau ...	...	8	...	...	...	8	
	Madame Treyve ...	...	10	5	...	...	15	
	William's Bon Chretien	...	9	...	...	5	14	
	Marguerite Marillat...	...	12	...	...	5	17	
	Doyenne du Comice...	...	10	...	...	5	15	
	Fondante Thirriot ...	...	...	5	...	...	5	
	Louise Bonne of Jersey	...	10	...	...	3	13	
	Conference ...	...	9	...	...	5	14	
Pear trees	Emile d'Heyst ...	...	9	...	...	...	9	
	Winter Nelis ...	...	5	...	...	...	5	
	Fondante d'Autemne	...	...	5	...	...	5	
	Beurre Superfin ...	...	...	...	...	5	5	
	Princess	...	...	5	...	5	10	
	Beurre Fouqueray ...	...	...	5	...	...	5	
	Beurre Diel ...	...	...	...	...	5	5	
	Directeur Hardy ...	...	...	5	...	...	5	
	Beurre d'Anjou ...	...	...	...	...	5	5	
	Colmar d'Ete ...	...	...	5	...	...	5	
	Total ...	...	106	35	...	48	189	
	Directeur Hardy ...	...	11	...	...	...	11	Horizontal trained.
	Duchess d'Angouleme	...	1	...	...	...	1	
	Clapp's Favourite ...	...	2	...	...	...	2	
	Josephine de Malines	...	1	...	...	...	1	
	Emile d'Heyst ...	...	2	...	...	...	2	
	Louise Bonne of Jersey	...	1	...	...	...	1	

Species of fruit trees.	Variety.	Planted 1914-17.				Planted 1913.	Total number.	Description.
		Upper garden.						
		Top block.	West block.	South block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9
Pear trees	Beurre Superfin ...	...	1	...	...	...	1	Horizontal trained.
	Princess	...	6	...	...	...	6	
	Conference ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	2	...	...	...	2	
	Durondeau ...	...	1	...	...	...	1	
	Pitmaston Duchess ...	...	1	...	...	...	1	
	Fondante d'Automne...	...	1	...	...	...	1	
	Doyenne du Comice ...	...	2	...	...	...	2	
	Winter Nelis ...	4	...	...	...	...	4	
	Marguerite Marillat ...	...	5	...	...	...	5	
	Total ...	4	39	...	...	...	43	
	Marguerite Marillat ...	...	...	6	...	...	6	Standards.
	King Karl (Starks) ...	...	1	...	...	...	1	
	Anjou (,,) ...	...	3	...	...	...	3	
	Lincoln (,,) ...	...	3	...	...	...	3	
	Howell (,,) ...	...	6	...	...	...	6	
	Duchess (,,) ...	...	3	...	...	...	3	
	Bartlett (,,) ...	...	8	...	...	...	8	
	Seckle (,,) ...	...	4	...	...	...	4	
	Marie Louise ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	5	11	...	...	16	
	Conference ...	...	2	...	...	...	2	
	Emile d'Heyst ...	...	3	...	...	...	3	
	Madame Treyve ...	...	8	...	...	...	8	
	Count de Lamy ...	...	3	...	...	...	3	
	Louise Bonne of Jersey	...	2	...	...	...	2	
	Beurre Capiaumont ...	...	6	...	...	...	6	
	Princess	...	2	...	...	...	2	
	Doyenne du Comice ...	...	2	...	...	...	2	
	William's Bon Chretien	...	2	...	...	...	2	
	Souvenir du Congress...	...	2	...	...	...	2	
	Marie-Louise d'Uccle...	...	2	...	...	...	2	
	Fertility	...	28	5	...	...	33	
	Seckle	...	...	2	...	...	2	
	Total ...	...	97	24	...	...	121	

Species of fruit trees.	Variety.	Planted 1914-17.				Planted 1913.	Total number.	Description.
		Upper garden.						
		Top block.	West block.	East block.	Lower garden.	Lower garden.		
1	2	3.	4	5	6	7	8	9
Pear trees	Princess	...	5	...	...	...	5	Upright trained.
	Conference ...	...	...	...	...	3	3	
	Madame Treyve ...	...	...	5	...	...	5	
	Marie Louise d'Uccle ...	...	...	...	...	4	4	
	Louise Bonne of Jersey ...	...	...	...	...	4	4	
	Beurre Hardy ...	5	...	...	...	...	5	
	Fondante d'Automne...	...	...	...	...	3	3	
	Winter Nelis ...	...	...	...	4	...	4	
	Conseiller de la Cour...	...	...	...	...	3	3	
	Doyenne du Comice ...	...	...	...	...	3	3	
	Marguerite Marillat...	4	2	...	...	...	6	
	Total ...	9	7	5	4	20	45	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Late Transparent ...	...	...	...	...	6	...	6	Bush.
	Denistou's Superb Gage.	...	...	...	...	...	10	10	
	Satsuma	...	...	...	...	1	...	1	
	Prosperity... ...	...	2	...	...	...	...	2	
	Belle de Louvain ...	...	...	...	...	...	6	6	
	Utility	...	2	...	...	...	...	2	
	Greengage... ...	...	...	...	...	6	...	6	
	Heron	...	5	...	...	...	...	5	
	Monarch	...	...	3	...	...	...	3	
	Stark's Gold ...	3	...	...	...	...	...	3	
	Belgian Purple ...	...	...	...	...	...	10	10	
	Rutland Plumcot ...	1	...	...	...	...	...	1	
	Pond's Seedling ...	...	...	...	...	3	...	3	
	Stark's Shiro ...	1	...	...	...	...	...	1	
	Stark's Omaha ...	...	...	1	...	1	...	2	
	Autumn Beauty ...	...	...	1	...	...	...	1	
	King of the Damsons	...	...	...	...	2	...	2	
	Shepherd's Bullace ...	...	...	...	...	3	...	3	
	Langley's Bullace ...	...	...	...	...	3	...	3	
	White Damson ...	...	...	...	...	3	...	3	
	Prune Shropshire ...	...	...	...	...	3	...	3	
	Merryweather Damson	...	...	...	...	6	...	6	
	Stark's America ...	...	...	2	...	...	...	2	
	Burbanks Giant Prune	...	2	...	...	...	4	6	
	Total ...	5	11	7	...	37	30	90	
	Decaise	...	...	...	...	1	...	1	Fan trained.
	Kirkes	...	...	...	...	2	...	2	
	Jefferson	...	...	...	...	2	...	2	
	Mallard	...	...	...	...	1	...	1	
	Golden Esperen ...	...	...	...	...	1	...	1	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1923. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Oullin's Golden Gage	...	...	...	...	2	...	2	Fan trained.
	Reine Claude d' Althan.	...	...	...	...	1	...	1	
	Early Transparent	...	...	...	...	1	...	1	
	Coe's Golden Drop	...	...	...	...	1	...	1	
	Transparent Gage	...	...	...	...	1	...	1	
	Greengage	...	...	...	...	2	...	2	
	Golden Transparent Guge.	...	...	...	...	1	...	1	
	Belgian Purple	...	...	...	...	1	...	1	
	Total	...	...	...	...	17	...	17	
Cherry trees ...	Morello	...	...	...	3	3	...	6	Trees.
	Kentish	...	...	...	...	...	16	16	
	Bigarreau Kentish	...	...	...	...	...	6	6	
	Gloire de France	...	...	...	...	...	5	5	
	White Heart	...	...	...	...	...	4	4	
	Black Heart	...	...	...	...	...	5	5	
	Kashmir	...	22	...	...	...	...	22	
	Montmorency King	...	1	...	...	1	...	2	
	Burbank	...	4	...	...	1	...	5	
	Total	...	27	...	3	5	36	71	
	Turkey Black Heart	...	...	...	...	1	...	1	Fan trained.
	Late Black Bigarreau	...	...	...	...	1	...	1	
	Frogmore Bigarreau	...	...	...	...	1	...	1	
	Noir de Guben	...	...	...	...	1	...	1	
	Belle de St. Trone	...	...	...	...	1	...	1	
	Early Rivers	...	...	...	...	1	...	1	
	Total	...	...	...	...	6	...	6	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Orange trees ...	Japanese Satsuma ...	...	1	...	...	1	...	2	
	Japanese Kumquot ...	...	8	...	...	4	...	12	
	Malta Blood ...	...	4	...	...	...	2	6	
	St. Michael's ...	...	1	...	...	1	...	2	
	Jaffa	...	2	...	...	1	...	3	
	Malta Oval ...	...	2	...	...	1	...	3	
	Silver	...	3	...	...	...	1	4	
	Excelsior	...	1	...	...	1	...	2	
	St. Michael's Tangierin.	...	1	...	...	...	5	6	
	St. Michael's Dom Louise.	...	1	...	...	2	...	3	
	St. Michael's Sustain	...	1	...	...	...	1	2	
	Ditto Achilles	...	...	...	...	...	1	1	
	Total ...	...	25	...	...	11	10	46	
Lemon trees ...	Imperial Lemon ...	...	...	...	...	...	2	2	Trees.
	Bijou ,, ...	...	...	...	...	4	...	4	
	Total ...	...	...	...	...	4	2	6	
Walnut trees ...	Dwarf Prolific ...	...	7	...	...	...	10	17	
	Total ...	...	7	...	...	...	10	17	
Peach trees ...	Princess of Wales ...	...	...	...	3	...	...	3	
	Peregrine... ...	...	...	...	...	3	13	16	
	Alexander... ...	...	...	...	...	3	10	13	
	Duke of York ...	...	...	...	...	1	16	17	
	Exquisite	...	...	...	...	...	2	2	
	Late Devonian ...	...	...	...	...	2	...	2	
	Lady Palmerston ...	...	...	...	...	2	...	2	
	Kestrel	...	...	...	...	6	...	6	
	Hales Early ...	...	...	...	...	3	...	3	
	Total ...	...	...	...	3	20	41	64	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1918. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apricot trees ..	Superb (Starks) ...	...	...	...	...	1	...	1	Trees.
	Blenheim ...	...	...	...	...	6	...	6	
	Total ...	...	...	...	...	7	...	7	
Fig trees ...	White Marseilles ...	...	...	...	...	...	3	3	
	Bourjassotte Grise ...	...	...	...	...	...	3	3	
	Monaco Bianco ...	...	...	...	...	...	3	3	
	Total ...	...	...	...	...	...	9	9	
Quince trees ...	Weeks Prolific ...	...	1	...	...	1	...	2	
	Champion... ...	...	1	...	...	...	...	1	
	Portugal	...	1	...	...	1	...	2	
	Total ...	...	3	...	...	2	...	5	
Almond trees ...	Hill Almond ...	...	12	...	...	...	...	12	
	Total ...	...	12	...	...	...	...	12	

Species of fruit trees.	Variety.	Planted 1914-17. Upper garden. Top block.	East block.	North block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
Wineberry	.....	...	...	...	6	...	6	Berries.
Lowberry	.....	...	...	...	...	6	6	
Rubus Cratægifolius ...	.....	...	...	...	5	...	5	
King's Acre Berry ...	.....	...	...	...	5	...	5	
Loganberry... ...	.....	...	...	...	3	1	4	
Phenomenal ...	.....	...	...	...	3	1	4	
Laxtonberry ...	.....	...	...	...	3	...	3	
Blackberry... ...	Blowers	...	...	...	100	...	100	
Ditto	Pyne's Giant Himalaya Berry of California.	...	...	...	100	...	100	
	Total ...	...	...	...	225	8	233	
Raspberry... ...	Pyne's Royal ...	20	...	...	...	...	20	Berries.
	Park Lane ...	...	...	...	20	...	20	
	November Abundance	...	...	...	30	...	30	
	Pyne's Devon ...	...	...	...	6	...	6	
	Bunyards Goldendrop	9	...	...	...	...	9	
	Total ...	29	...	...	56	...	85	
Strawberry ...	Givon's late Prolific...	...	...	...	900	...	900	Plants.
	Louis Gauthier ...	...	500	...	350	...	850	
	Royal Sovereign ...	...	3,000	...	1,250	...	4,250	
	Laxton's Cropper ...	...	...	...	400	...	400	
	Total ...	...	3,500	...	2,900	...	6,400	
Currant	Boskoop Giant Black	...	2	...	...	...	2	Bushes.
	Defender Black ...	...	1	...	...	...	1	
	Southwell's Black ...	...	20	...	20	...	40	
	Total ...	...	23	...	24	...	47	

Species of fruit trees.	Variety.	Planted 1914-17.				Planted 1913.	Total number.	Description.
		Upper garden.						
		Top block.	East block.	North block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9
Nut trees... ...	White Filbert ...	...	...	...	2	...	2	Trees.
	Red Filbert ...	...	...	...	3	...	3	
	Prize Cob ...	...	...	...	3	...	3	
	Kentish Cob ...	...	...	...	3	...	3	
	Total ...	...	...	...	11	...	11	
Grape Vines ...	Campbell's Early (Starks).	...	2	...	...	...	2	Vines.
	Hicks (Starks) ...	...	3	...	...	...	3	
	King (,,) ...	...	2	...	...	...	2	
	Eclipse (,,) ...	...	2	...	...	...	2	
	King Philip(,,) ...	...	2	...	...	...	2	
	Wilder (,,) ...	...	2	...	...	...	2	
	Worden (,,) ...	...	2	...	...	...	2	
	Niagara (,,) ...	...	2	...	...	...	2	
	Total ...	...	17	...	...	...	17	

Summary of Fruit Trees planted to 30th June 1917.

	1913.	1914-17.	Total.
1	2	3	4
Bush Apple trees	434	1,896	2,330
Standard „ „	49	631	680
Horizontal trained Apple trees ...	27	48	75
Upright „ „ „ ...	10	25	35
Palmette Verrier „ „ „ ...	...	23	23
Fan „ „ „ ...	...	5	5
Double Cordon „ „ „ ...	...	3	3
Single „ „ „ ...	...	3	3
Bush and Pyramid Pear „ ...	177	275	452
Single Cordon „ „ ...	48	141	189
Horizontal trained „ „ ...	...	43	43
Standard „ „ ...	...	121	121
Upright trained „ „ ...	20	25	45
Bush Plum trees	30	60	90
Fan trained Plum trees	...	17	17
Cherry standard trees	36	35	71
Cherry fan trained trees	...	6	6
Orange trees	10	36	46
Lemon „	2	4	6
Walnut „	10	7	17
Peach „	41	23	64
Apricot „	...	7	7
Fig „	9	...	9
Wineberry...	...	6	6
Lowberry	6	...	6
Rubus Crataegifolius	...	5	5

	1913.	1914-17.	Total.
1	2	3	4
Loganberry	1	3	4
King's Acre Berry	...	5	5
Phenomenal „	1	3	4
Laxtonberry „	...	3	3
Giant Himalaya Blackberry	...	100	100
Blower's Blackberry	...	100	100
Raspberry...	...	85	85
Strawberry plants	...	6,400	6,400
Currant Bushes	...	47	47
Almond trees	...	12	12
Nut „	...	11	11
Quince „	...	5	5
Grape Vines	...	17	17

C. H. HOLDER,

In charge, Fruit Experiment Station, Shillong.

The 24th August 1917.

Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st July 1916 to 30th June 1917.

Receipts.	Amount.			Expenditure.	Amount.		
1	2			3	4		
	Rs.	a.	p.		Rs.	a.	p.
Sale-proceeds of Apples ...	100	4	0	Allowance to Superintendent	3,000	0	0
„ of Peaches ...	3	0	0	Establishment ...	2,340	0	0
„ of Strawberries	140	8	0	Petty construction ...	633	13	7
„ of Strawberry plants.	79	0	0	Seeds, Plants and Manures	1,916	14	11
				Instruments, appliances and machinery.	32	15	0
				Wages of labourers ...	5,974	3	0
				Service postage ...	15	0	0
				Other charges ...	411	15	3
Total Receipts ...	322	12	0	Total Expenditure ...	14,324	13	9

ANNUAL REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 30TH JUNE 1917.

General.

This station was established in January 1914. It is situated on the Sylhet road, 3½ miles to the west of the subdivisional station of Karimganj which lies on the Assam-Bengal Railway.

The total area of the farm is a little under 80 acres. Leaving out a compact block of 8 acres which has been set apart for the farmstead and quarters for the staff, and the area covered by roads and drains, the net area available for cultivation is about 68 acres.

The station is devoted mainly to experimental work on rice and jute.

Character of land and soil.

2. The farm lies close to the Langai river which occasionally rises in high flood and lays the country all round under water. This liability to floods is characteristic of the rice-lands in the locality.

The soil of the greater portion of the farm is a deep alluvial clay of fine texture, though not particularly heavy. In the higher lands, it is somewhat lighter in character and may be described as a medium loam.

Equipment.

3. During the year a new building was erected to provide much needed accommodation for the increased number of farm apprentices now being entertained. This is a *kutcha* building erected at a cost of Rs. 200 and will provide accommodation for eight additional men.

Owing to the increase in the number of varieties of rice under experiment, the existing godown accommodation was found insufficient. In order to increase the storage space a special granary division was made in the godown at a cost of Rs. 180, and an extension was added to the barn at a cost of Rs. 100.

The only work of reclamation undertaken during the year was the digging of a jute steeping pond at a cost of Rs. 100.

A long drain, leading from the south-east corner of the farm to a *khal* near by, was dug during the previous year for the purpose of draining the residential area; in former years this area was liable to be converted into a swamp during the rainy season.

It was subsequently found that when the water rose in the Langai river during high flood, there was a back-flow up the abovementioned *khal* or stream and along this drain. It was, therefore, decided to erect a small sluice gate with the object of preventing such back-flow of river water into the farm lands.

The work was carried out in the cold weather of 1916-17 at a cost of slightly under Rs. 100 and should prove beneficial. Fortunately, however, we had no floods to test the efficacy of the new sluice gate up to date.

The total number of cattle remains at 30 as at the close of the previous year. In July 1916 the farm stock suffered from an outbreak of foot-and-mouth disease, and fifteen head were affected more or less seriously.

The local Veterinary Assistant attended regularly and the farm staff co-operated whole heartedly in carrying out his instructions, with the result that every beast recovered without the slightest blemish.

The work of the farm was well in advance at the time of this outbreak and, as the healthy cattle were kept moving briskly, the farm work did not suffer any serious delay.

One bullock died from anthrax in February 1917, and a new one was purchased at a cost of Rs. 32 to take his place.

The other bullocks were inoculated immediately and no further cases occurred.

Character of the year.

4. The official agricultural year is found extremely inconvenient for the purpose of report. It covers the latter half of one *kharif* season and first half of the *kharif* season following, and includes, of course, the *rabi* season intervening.

The following table shows the rainfall during each of these periods :—

—	Actual.	Normal.
1	2	3
Last half of kharif, 1916.		
July 1916	41·61	23·11
August „	20·46	22·83
September „	13·94	18·58
October „	14·91	8 31
Total ...	90·92	72·83

—	Actual.	Normal.
1	2	3
Rabi, 1916-17.		
November 1916	1·09	1·31
December „	...	0 56
January 1917	0·12	0·75
February „	7·34	1·46
Total ...	8·55	4·08
First-half of kharif, 1917.		
March 1917	0·64	8·80
April „	13·28	18·72
May „	13·56	21·19
June „	25·76	31·45
Total ...	53·24	80·16
Total for the year...	152·71	157·07

The *kharif* season of 1916 was a most promising one and the prospect of a bountiful harvest continued until October.

In that month, however, excessive rainfall occurred in the hills which rapidly filled the rivers with an unprecedented volume of water. This was accompanied by what, under ordinary circumstances, would have been looked upon as a comparatively slight excess of local rainfall and resulted in a flood even more injurious than that of the previous year.

The actual damage to the crops on the farm, while considerable, was not so great as that produced by the 1915 floods, but, owing to the late season at which the damage occurred, was the cause of greater loss, seeing that it was then too late to replant the rice crop as had been successfully done in the previous year.

Most of the experiments in progress at the farm were so much injured as to yield comparatively valueless results, although a crop about 40 per cent. below the average was obtained.

The early months of the *rabi* season were much drier than usual, the excessive rainfall of February was too late to be of use and the result was that cold-weather crops on the farm only yielded a small return in the majority of cases.

The present *kharif* season started unfortunately with a drought in the month of March, which delayed cultivation for the early paddy crop. During the next three months the rainfall was evenly distributed but somewhat lighter than the average for that period.

The farm crops are now doing well and the outturns from the present appearances are likely to prove satisfactory. The only exception is a portion of the early jute crop which was severely checked by lack of moisture and by injury from hail in the young stages of growth.

Rice breeding.

5. As befits a station situated in such an extensive rice-growing district as the Surma Valley, attention is devoted mainly to effecting improvements in this staple.

Rice breeding experiments were arranged in 1914 after a consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Rai Bahadur B. C. Basu, Special Officer for Agriculture, and Mr. G. P. Hector, Economic Botanist, Bengal. These experiments have been carried on since.

It was hoped to obtain definite results after three or four years' work, but, owing to the unfortunate floods which have interfered with the continuity of the experiments, the work has been delayed and a further period of a year or two will be required before definite results can be expected.

Ordinary rice seed is usually found on examination to be a mixture of different types of unequal quality and productive power. Some of these types are pure, and, therefore, breed true; others are the products of natural crossing and split into types differing in character and are consequently unreliable. The types also differ in regard to their productive power and other characters.

The method of breeding followed on the farm starts by growing in the first season, from ordinary village seed, as many local varieties of rice of each class as we can procure, and in picking out from each as many distinct types as we can detect while the crop is still standing in the field, each type being represented by the ripe ears taken from a single plant.

The next step is to grow the various lots of seed thus obtained in small plots side by side, first with the object of testing which of these types are constant and therefore, pure, and which again split as the result of previous crossing, and, secondly, with the object of comparing the pure types in regard to yielding power

and other characters. Though the rice flower is normally self-fertilised, a certain amount of natural crossing is known to occur. A clear space of 3 to 6 feet around each plot is kept in order to minimise the risk of inter crossing between adjacent types.

The next and third step is to take the pure types and grow them a second or even a third time (which is to be the work of the third or fourth season) in order to confirm the results of the second season as to their respective merits.

In this way at the end of the third or fourth season, we should be able to fix upon one or more of these pure lines, as being more prolific and of better quality all round than the rest within their own class. The next and last step will be to propagate these selected pure lines on a field scale for the purpose of distributing the produce as seed.

The experiment was commenced in 1913-14 with four classes of rice, namely, (1) early *aus* rice, which is usually grown broadcast and of which two crops may be taken in the course of a year, (2) trasplanted *aus*, (3) *sail* or winter rice, (4) *asra*, which comprises the comparatively short stemmed varieties of *amon* or swamp winter rice, and which is capable of being grown either broadcast or transplanted.

The floods of 1915 destroyed all work done up to that time with transplanted *aus*, *sail* and *asra*, and the selection work with regard to these classes had to be undertaken *de novo*. It was then decided to restrict the work for some years to come to (1) early *aus* which was spared by the 1915 floods and (3) *sail* transplanted winter rice which forms the most important class of rice grown in the country.

Below is noted the work done on these two classes of rice since the experiment started.

Early aus.—This class comprises three sub-classes of rice, *viz.*, *murali*, *chengri* and *dumai*. These differ from each other in regard to the depth of water which they can stand during the latter stages of growth and the time they take from sowing to harvest. A total of 161 distinct types was obtained by the selection work done in 1914. Out of these, 61 were obtained early enough to permit of their being sown again in September of that year.

The resulting plants were examined as to purity and three types were rejected as unsuitable for further work. Early in 1915 these types were sown again but were destroyed by the July flood of that year. Fortunately, however, duplicate halves of the seed of 57 of these types had been kept in reserve, as a precaution

against the accidental loss of the stock, and with this seed the work was continued in that year. These 57 types of early *aus* were sown in September and reaped in December 1915, and as was to be expected, the yields varied within very wide limits. From the seed thus obtained three further series of plots were sown in May 1916, that year's crop being the third generation from the first selected types. Full records are kept of the dates of sowing, flowering, and harvesting of each type and of its yield of grain and straw. These particulars, together with a description of the characters of each type, are kept in a register of pure cultures on the farm. As was expected, the variations in yield among the plots of the third generation were considerable and not sufficiently in agreement with the yields obtained in the first two generations to enable a selection to be made.

A further set of one series was laid down in September 1916 with seeds from the early crop of that year. These plots were injured by the October floods to such an extent that comparative results could not be obtained although sufficient seeds of this—the fourth generation—were harvested, to enable the work to be continued in the present year. One of these types was obviously different from the other, and it has in consequence been discarded.

During the present year it is proposed to grow a further two generations of the remaining 56 types, and if no untoward accident occurs to affect the yields, it is hoped that definite information may be gathered as to which are the most desirable types.

Sail.—This is the most important class of rice in Assam. As the result of the work done in 1915, 580 types were separated and these had just been sown in seed beds when the great flood of July came and destroyed them all. For the purpose of making the primary selection of types for a fresh start, seeds of 148 varieties of this class of rice were then collected, mostly from different parts of the Sylhet district, a few being obtained from the Sibsagar district, and some being the produce of the farm itself. On receipt of these varieties of *sail*, each was described in detail and all particulars entered in the "Register of type selection of *sail* rice" kept on the farm.

The seeds of these 148 varieties were sown in June and transplanted towards the end of July 1916. Although the plots were injured by the October floods, sufficient plants remained to enable a representative type to be selected from each plot for the present year's work.

Four additional types have been included this year bringing the total up to 152.

All were sown towards the end of the year under report and are to be grown as pure line cultures this season.

A new line of selection—intra-varietal selection—was recommended by Mr. Hector, Economic Botanist of Bengal, and incorporated in the Cropping Programme for 1916. *Lati sail*, as representing one of the most productive varieties of *sail* rice, was selected as the basis for this work. The crop was damaged by flood, but the experiment is being continued in the present year.

The main points of the work are :—

(1) To grow this productive variety of rice under favourable conditions.

(2) To pick out at random a number of plants of one type and arrange them in the order of their productiveness, as shown by the weights or number of grains produced by each.

(3) To preserve the seeds from each plant separately, and use them as pure lines and compare the yields obtained.

Minor experiments.

6. The experiments carried out on a small scale included the following :—

(1) *Bonemeal as manure for double crop rice land* versus *no manure*.—This experiment which was begun in 1915 was designed to give some information, firstly, as to whether or not bonemeal manuring will prove profitable on the Karimganj Farm and similar rice lands, and, secondly, as to the quantity of bonemeal which should be applied.

Bonemeal has been used at three different rates, *viz.* :—

(*a*) At 247 pounds per acre applied in 1915 and no manure in 1916.

(*b*) At 494 pounds per acre applied in 1915 and no manure in 1916.

(*c*) At 247 pounds per acre in 1915 and 3 maunds per acre in 1916.

The first crop of 1915 and the second crop of 1916 were injured by floods and no results were available. The yields, as far

as they have been obtained for the two years, are shown in tabular form :—

	Yield per acre, in pounds.		
	1915 2nd crop.	1916 1st crop.	Average of two crops.
1	2	3	4
Bonemeal 247 pounds per acre, 1915, and no manure in 1916.	3,289	1,578	2,433
No manure	3,009	1,477	2,243
Bonemeal 494 pounds per acre, 1915, and no manure, 1916.	3,122	1,600	2,361
No manure	2,190	1,357	2,271
Bonemeal 247 pounds per acre, 1915, and 247 pounds per acre, 1916.	...	1,649	...
No manure	...	1,470	...

The disturbing effect of the floods makes this experiment of little value up to the present.

The average yields, however, indicate that a light application will be more profitable than a heavy application.

The question as to whether or not any application of bonemeal is likely to yield a profit on soil such as that of Karimganj Farm can only be decided by a continuation of the experiment.

(2) *Green manuring for the rice crop* versus *no manure*.—This experiment, started in 1915 with cowpea and *Dhaincha*, was continued in 1916 with slight modifications. Duplicate plots were treated with ground limestone at 823 pounds per acre in the past year, the average yields of paddy per acre being as follows :—

	Pounds.
Dhaincha alone	1,586
No manure	1,397
Dhaincha and 823 pounds ground limestone ...	1,469
No manure	1,251
Cowpea alone	1,294
No manure	1,251
Cowpea and 823 pounds ground limestone ...	1,691
No manure	1,397

The cowpea did not grow well and even on the limestone area it was very poor. *Dhaincha* gave a very successful crop and was specially good on the plot manured with ground limestone.

The *sail* paddy crop was slightly damaged in parts by the October floods and therefore the above figures are not absolutely comparative.

There would, however, seem to be no doubt of the benefit to the succeeding rice crop of a well grown leguminous crop.

(3) *A combined variety and manurial experiment on jute.*— As in 1915 three varieties were tested against one another, *viz.*, a pure line bred by Mr. R. S. Finlow, Fibre Expert, Bengal, a local variety, and a variety obtained from the Goalpara district.

The average outturn of fibre in pounds per acre for the two years was as follows :—

———	Mr. Finlow's.	Local variety.	Goalpara.
1	2	3	4
Yield per acre in 1915	2,036	1,224	1,738
Yield per acre in 1916	1,734	1,115	1,042
Average for two years	1,885	1,169	1,390

A fresh supply of seed was obtained last year of all three varieties and it would seem from the yield that the Goalpara lot was not so good as that obtained in the previous year.

The yields obtained from Mr. Finlow's variety leave no doubt of the great superiority of this selection to any of the ordinary varieties.

The manurial experiment consisted of a comparison of the yields of fibre obtained from (*a*) an unmanured area, (*b*) an area manured at the rate of 5½ tons of cowdung per acre, (*c*) an area manured at the rate of 5½ tons of cowdung and 247 pounds bonemeal per acre. The average results were :—

———	No manure.	Cowdung.	Cowdung and bonemeal.
1	2	3	4
Yield per acre, in pounds	504	1,055	1,884

These results show in a very striking manner the benefits of manuring the jute crop on lands such as those of the Karimganj Farm. Although excellent results have followed from the use of bonemeal, it is not claimed that this is the most suitable class of manure for a crop like jute.

(4) *Jowar as fodder in the rains.*—*Jowar* was grown both as a rains crop and as a cold-weather crop. The seed for the rains crop was sown on slightly more than half an acre of land in May. Half of this land was manured with cowdung only, applied at the rate of 5½ tons per acre. The other half received a similar quantity of cowdung, and in addition was dressed with ground limestone at 823 pounds per acre.

Cowdung alone gave a crop of green fodder weighing 5·2 tons per acre, while cowdung and ground limestone gave a crop of 7·7 tons per acre.

It was intended to keep some of this crop for seed. After the October floods there was no pasture available for the farm cattle and only a small quantity of old paddy straw. Accordingly all the *jowar* had to be used for feeding the farm cattle.

It was extremely fortunate that we had the *jowar* crop, as the thirty head of farm cattle were kept in first class condition for several weeks by its help. By the end of that time, *kalai* which had been sown immediately after the flood, was ready for grazing and supplied food for the cattle until there was again some grass and a further supply of paddy straw.

A larger area of *jowar* and of a mixture of *jowar* and cowpea is being grown this season to enable experiments to be carried out in the making of ensilage.

(5) *Mr. Hector's improved rices against country rices.*—As in 1915, Mr. Hector's selected rices, *Indrasail*, *Lambachikan* and *Kandulia*, were tested against two of the most productive local rices named *Latisail* and *Terabali*. This experiment was also injured by the floods, and consequently the yields are not absolutely comparative. However, they are now given as they seem to show that the Bengal rices which have proved so promising in their own country are likely to be of value under the somewhat similar conditions of the Surma Valley.

The average yields per acre of those plots which were least injured were :—

	Pounds.
Terabali (local variety)	1,401
Indrasail (Mr. Hector's)	1,534
Kandulia (Mr. Hector's)	1,606

All five varieties are being tested again this year in the hope that more decisive results will be obtained.

(6) *Improved varieties of sugarcane from the Jorhat Farm.*—The three varieties B 147, B 376 and Striped Mauritius were grown as a ratoon crop on a small scale and the sugarcane made into *gur*.

The farm lands are situated at too low a level for the successful growth of sugarcane on a large scale, but this small experiment was carried out with the object of giving the farm apprentices a knowledge of the cultivation of sugarcane and of the making of *gur*.

The yields of *gur* averaged practically the same for all three varieties, *viz.*, about 3,000 pounds per acre.

Non-experimental crops.

7. A large area of non-experimental rice was grown during the year. Together with the experimental rice, it covered almost the entire area of the cultivated portion of the farm, the balance being occupied by small areas of sugarcane and of jute and *dhaincha* which were grown for seed.

The total yield from the rice crop including the experimental *sail* rice was as follows :—

	Approximate area.	Total yield.	Yield per acre.
1	2	3	4
	Acres.	Tons.	Pounds.
Rice (*asra*)	27·25	15·32	1,260
Rice (*sail*)	23·00	8·22	805
Rice (experimental area—*sail*) ...	3·65	1·72	...
Total in 1916	53·90	25·26	1,051
Total in 1915	52·64	47·98	1,991

This very serious drop in crop outturn as compared with the previous year was due to the October floods.

Dhaincha was kept for seed on an area of ·3 acres and gave an outturn of 325 pounds or at the rate of 1,084 pounds per acre.

Cultivation of cold-weather crops.

8. In view of the series of disastrous floods which has been experienced in recent years it was felt that attention ought to be paid to cold-weather cropping. Accordingly in the cold-weather season

1915-16 small plots of the following cold-weather crops were laid down :—*Jowar, kalai, khesari, musur, mung, gram, linseed, mustard, coriander, peas, wheat, oats, barley, radish.* Some of the pulse crops were sown on silt but, probably on account of the clayey nature of the silt and the fact that there was extremely little rain in the early part of the *rabi* season, the crop was poor on many of the plots.

The average yields per acre are now given :—

Crop.	Yield per acre, in pounds.	Remarks.
1	2	3
Wheat	423	Did not tiller.
Barley	642	
Oats	1,357	
Peas	786	
Rabi Jowar	...	Was a small crop which was made into ensilage and fed to the farm cattle.
Radish	154	
Mustard	146	Was injured by aphides.
		The best plot gave at the rate of 400 pounds per acre.
Linseed	565	
Coriander	864	
Kalai	216	The early sown crop was destroyed by the flood. Another part was sown very late and gave small outturn. The best crop, sown on silt, gave at the rate of 480 pounds per acre.
Khesari	218	The best results were obtained where the seed was sown on silt among the remaining paddy plants.
Musur	103	
Mung	...	Was a failure.
Gram	271	

Taken all over, the yields from cold-weather crops were small; this was no doubt largely due to the fact that the early part of the *rabi* season was excessively dry and these crops had in consequence a very unfavourable start. Notwithstanding the adverse conditions, oats and peas gave comparatively good yields.

Linseed was much the best of our oilseeds. Coriander seems a promising miscellaneous crop. The pulse crops, it must be admitted, were not successful as a whole, yet there are some crumbs of comfort to be extracted from the work. The fact that a crop of *kalai* yielding at the rate of 480 pounds per acre was grown on about half an acre of silt-covered land is suggestive of what might be done towards increasing food production in the cold-weather. The only outlay in this case was the cost of seed and of labour which would not, at the most, exceed Re. 1-8 per acre. *Khesari* sown similarly among the paddy stems gave about 240 pounds per acre. This, though small, would be a paying return considering the smallness of the outlay necessary.

Insect pests.

9. Although different insect pests made their appearance at various times of the farm, no very serious damage resulted.

The Farm Manager took timely steps to combat any pests of the kind. Hand picking, catching by light traps and by bag net, were variously resorted to and the result was that no damage of any consequence was suffered by the farm crops during the year, although many of the neighbouring crops suffered considerably.

In the early stages of the development of the hairy caterpillars the grubs are found clustered together on the leaves of the affected plants during the first few days after hatching out. At this stage much damage can be avoided by picking off the leaves bearing clusters of caterpillars and killing them in hot water or a little kerosine oil. This method was very successful in the case of the farm jute crop which was badly attacked last year.

Rice bugs (*Leptocorisa varicornis*) are the cause of immense damage to the rice crop each year and particularly to the early varieties. The most effective method we have found of checking the ravages of these insects, is to prepare a light cloth about fifteen feet long and four feet wide. Two boys use this by standing at opposite ends of the cloth, and with a corner in each hand they allow the middle to fall and bring up the sides until they are about 18 inches apart. One side of the bag net so formed, is allowed to sweep along the top of the affected crop, while the workers run quickly across and across the plot. At each end the bag net is closed and twisted to destroy the many bugs which are captured in this way.

The stem borer moth is attracted by any light during the night time and can be easily tempted to his undoing on this account. An ordinary hurricane lamp is suspended over a barrel or tub of water which has been covered with a light film of

kerosine oil. The moths flutter in large number round the lamp and most of them ultimately fall into the water and are killed by the kerosine. Where no large vessel is available, a small raised pond could be made with mud banks, filled with water and covered with a spoonful of kerosine, and a torch placed over it would provide sufficient attraction.

Receipts and expenditure.

10. The receipts during the year amounted to Rs. 827-6 derived mostly from the sale of paddy. In addition there were balances of paddy, *kalai*, etc., at the end of the agricultural year worth approximately Rs. 1,510 making the total income for the year Rs. 2,337 as compared with Rs. 3,628 for the previous year.

The total expenditure was Rs. 7,294-2-11 which compares with Rs. 7,336-4 in the previous year. It was distributed as follows :—

	Rs.	a.	p.
Establishment	2,467	13	11
Petty construction, including fencing, roads, bridges, etc.	600	0	0
Purchase of machinery	25	0	0
Reclamation	204	8	9
Feed of cattle	345	7	2
Seeds, plants and manures	34	0	9
Wages of labourers	2,330	11	6
Petty repairs	541	4	1
Books, maps and periodicals	23	11	0
Service postage stamps and telegrams ...	50	0	0
Unspecified charges	534	12	3
Purchase of furniture	104	9	6
Purchase of cattle	32	4	0
Total	7,294	2	11

Staff.

11. The sanctioned establishment of the farm consists of—

	Rs.	
1 Farm Manager	100—5—200	
1 Assistant Farm Manager	25—1-8—40	Plus Rs. 10 local allowance.
1 Farm Clerk	25—1-8—40	
1 Peon	8	

In addition arrangements are made for the entertainment of 6 apprentices, to be trained for eventual employment as Agricultural Demonstrators. The term of training extends to 2 years.

The first apprentice trained at the farm was appointed as Demonstrator in August 1915. During the year under report 3 young men completed their training and are now at work as Demonstrators. The vacant apprenticeships were immediately filled up and at the present time the full complement of six young men are under training. During the year the scheme of giving a preliminary practical training to young men of the *Bhadralog* class intended for scholarships at Sabour was inaugurated. These young men, who are given an opportunity of qualifying for posts as Agricultural Inspectors, are to be trained in practical agriculture for one year. Two were selected in the beginning of the year under report; one put in an appearance at the farm but left soon afterwards. The other, Babu Pulin Behari Ghosh, put in his trial period satisfactorily and has since been awarded a scholarship at Sabour. Two young men have been selected for the vacant apprenticeships and have joined at the farm shortly after the end of the year under report.

Babu Surendra Nath Gupta, who was in charge of the farm at the beginning of the year, has since August 1916 been confirmed in the appointment of Farm Manager.

Srijut Lalit Mohan Das, who held an appointment as Temporary Agricultural Officer and really acted as Assistant Farm Manager, was appointed Agricultural Inspector, Karimganj and Cachar, in August 1916, and Srijut Nabin Chandra Barua was then promoted from the post of Demonstrator in the Assam Valley to the post of Assistant Farm Manager which he still holds at the end of the year. Babu Nirod Behari Sarma held the post of Farm clerk throughout the year.

CAMP DHUBRI,
The 5th August 1917.

J. W. McKAY,
Deputy Director of Agriculture, Surma Valley and Hill Districts.

ANNUAL REPORT OF THE KAMRUP SUGARCANE EXPERIMENT STATION FOR THE YEAR ENDING 30TH JUNE 1917.

Introductory.—The objects and scope of this experiment were set out in paragraph 1 of the report for 1914.*(1)

For reasons explained there it was proposed to take up 1,000 acres more or less, reclaim it and grow cane on it. Unforeseen circumstances have delayed the full accomplishment of this scheme to-date. The area reclaimed and under cultivation at the present time is 12 blocks comprising 650 acres in all, of which some 500 acres are now under cane, plant and ratoon. The area under cultivation on 30th June 1916 was 375 acres, the remaining 275 acres having been reclaimed during the year under report.

Last year's report dealt with the crop planted, February—March 1916, and its cultivation and progress to 30th June 1916. The present report is concerned with the subsequent development of that crop, which was harvested, February—April 1917, and also with the operations appertaining to this the third year of experiment proper, covering the preparation of the land, planting the crop and its subsequent cultivation and behaviour to the end of June 1917.

2. *Land and communications.*—The site of the experiment is situated in North Kamrup under the Bhutan Hills, about 17, miles by road north of Nalbari station, Eastern Bengal Railway and lies between the new and old Pagladiya rivers and near the village of *Topclia*. The farm is approached from Nalbari station by a public road northward to Garbhitar village, some 10 miles, where a village track leading to Khagrabarigaon has been widened out and made into a carting road and extended to the present farm site which is 7 miles from Garbhitar. The greater portion of this tract consists of high land carrying tall grass jungle, with occasional swamps which are, however, capable of drainage, the fall from the hills to the south being from 15 to 20 feet per mile.

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*(1) Annual Report of the Kamrup Sugarcane Experiment Station, year ending 30th June 1914.

3. *Rainfall.*—Farm records have been kept since January 1915; the following figures are for the Agricultural year ending June 30th, 1917:—

	Inches.
July 1916	14·03
August „	14·30
September „	10·34
October „	11·16
November „	nil.
December „	0·27
January 1917	nil.
February „	3·58
March „	1·20
April „	2·36
May „	8·48
June „	21·93
Total	97·65

The rainfall during 1916 was copious, total 101 inches, and well distributed, extending to the third week in October, when it suddenly ceased.

From the 1st January to the end of May 1917, which covers the important periods of planting, germination and early growth, the rainfall was very much less than for the corresponding months of the two previous years, and the young plant cane suffered somewhat in consequence. (*Vide* paragraph 13.)

4. *Soil.*—The soil of the high land varies from good loam to sandy loam on a sandy sub-soil. In few places, the sand comes to the surface, but usually there is from 1 to 3 feet of good soil, while in the swamps the soil is stiff, on a stiff sub-soil, although it is probable that sand exists at no great depth. Except on the few sandy patches the soil is dark brown or black in colour, denoting good supplies of organic matter. On the whole, the soil is a good loam, easily worked once reclaimed, and very suitable for cultivation. Moreover, the soil is well adapted to the climate; the annual rainfall being high and well distributed demands a light free draining soil such as exists here. Judging by the growth of the other crops, as well as sugarcane, the present fertility is high, and except on some of the lower lying parts, which before reclamation and drainage by us have probably been more or less swampy for generations, there is no evidence of any toxic factor; moreover, on these lower lying areas the toxic

factor apparently rapidly disappears under cultivation after drainage and heavy rain. The evidence of fertility as shown by the growth of many and diverse crops confirms some soil analyses made personally some 4 years ago on samples from an adjoining tract.

5. *Buildings, fencing, etc.*—The buildings consist of the Manager's bungalow, office with dispensary, coolie lines, cattle shed, godown, smithy, etc. The coolie lines were rebuilt during the year. Extension of the farm area necessitated the purchase of 2,000 yards wire fencing at a cost of Rs. 1,351, the whole farm being enclosed. It may be stated here that in spite of this, great destruction was caused in places by bears, though pig and deer, etc., were excluded by the fencing.

6. *Cattle.*—The 10 pairs of bullocks belonging to the Farm were reinforced by 31 pairs sent down by Mr. W. Maxwell, the cane contractor. These were steadily employed carting out machinery and plant for the factory, and during cane harvest.

An outbreak of rinderpest occurred early in 1917, and five pairs of bullocks died. At present, the remainder are in excellent condition.

7. *Water-supply.*—Norton tube wells are used with great success, and an excellent supply of drinking water is available all the year round. These wells distributed over the cane area, provide water also for the engines. In addition, a permanent running stream close by the coolie lines supplies water for washing purposes, etc.

8. *Labour.*—As much dependence cannot be placed on the local (Kachari) labour supply, most of our coolies are imported from Ranchi, being recruited personally by the Manager with the sanction of the Bihar and Orissa Government on a six monthly system. Many of these coolies settle down on the expiry of their term, and the system works quite satisfactorily. Speaking generally the labour force keeps very good health. A compounder was entertained during the year, and a dispensary started. No epidemics of a serious character have occurred heretofore. An epidemic of cholera in a village very near by carried off many of its inhabitants, but no cases at all occurred in our cooly lines, where well water only was used for drinking.

9. *Cultivating tackle.*—This comprises :

Two steam tractors compound engines, 1 five-furrow double ended plough, 1 harrow, 1 cultivator, 1 roller, 1 ridger, 1 leveller and 1 ditcher and a motor plough. Most of this tackle has now been in use for three seasons and is in excellent condition.

10. *Drainage scheme.*—The system of drainage adopted last year, outlined in paragraph 11 of the report for 1916, having proved so efficient, has been extended to the new area reclaimed, and is working quite satisfactorily. The water table has been considerably lowered in consequence, and the heaviest falls of rain are rapidly carried away, surface accumulations after such falls being now a thing of the past. The reclamation and drainage of new extension areas year by year undoubtedly improve the drainage of those areas previously reclaimed and put under cultivation, by dealing with water which heretofore used to flow in from surrounding unreclaimed land.

11. *Cane planted, February—March* 1916.—Refer to paragraphs 13 and 14 of last year's report. As therein shown some 230 acres of new cane were planted, making, with 40 acres of ratoons, a total of 270 acres under cane. The early growth of the crop, which was excellent, was described in paragraph 14 of last year's report, up to the end of June 1916. It remains to outline its subsequent progress. Well distributed rain continued up to the third week in October and the growth of the crop was all that could be desired up to that time. Some blocks continued to make growth into December, others ceasing growth and beginning to ripen off somewhat earlier, the operating factors being (*a*) variety, B-376 and Striped Mauritius ripening earlier than B-147, (*b*) whether ratoon or plant, ratoons ripening first, (*c*) the relative level of the land, ripening on lower lying areas being retarded. Ripening proceeded normally, Striped Maritius and B-376 ratoons being quite ready for the mill early in January. (Had the factory been ready, milling of these two varieties could have been commenced in December.) Ratoon B-147 was at that time not fully ripe. The plant cane ripened off in February and March.

Harvesting commenced on the 15th February and continued intermittently until the middle of April. Cane was supplied under contract to Mr. W. Maxwell, being sold to him on a sliding scale based on its Sucrose content and the price obtained for the *gur*.

Mr. Maxwell had erected a *gur* factory on the farm for dealing with the crop. Owing to unavoidable delay in the arrival of the machinery and plant manufacture was commenced very late. In consequence of this and other difficulties, climatic and otherwise, the manufacture of *gur* on a large scale with open evaporators was carried on under great difficulties and was found to be impracticable. In the result only some 775 tons of cane was dealt with in the factory, the remainder of the crop being

thrown away or distributed for sets. This was regrettable, but in all the circumstances unavoidable. The *gur* factory is now being converted into a white sugar factory on modern lines, and it is intended to convert the crop now on the ground direct into white sugar next cold weather. It is only fair to Mr. Maxwell to say that it was delay in the completion of the contract which prevented more being accomplished last year, and which led to the temporary expedient of installing the *gur* factory to save the crop if possible.

Despite the utmost exertions and the best intentions this laudable ambition, in the event, proved unattainable.

Outturn and quality of cane.—It is much to be regretted that owing to the adverse circumstances under which harvest and manufacture were carried on this year, hampered as we were by the uncertain and intermittent demands of the factory, by the contemporary planting up of extension areas, and by the despatch of a very large number of cane sets from the farm (some 2¼ lakhs of cuttings being sent out for sale and demonstration purposes), as also by the fact that the greater part of the crop had perforce to be cut and thrown away, it is quite impossible to say what the total crop was, as it proved out of the question to weigh it all. The whole of the cane entering the factory was weighed, but as this consisted largely of the bottom halves of canes of which the top parts were used for planting, the factory records are not of much assistance in estimating the crop yield.

The plant cane yielded the heaviest crops, the outturn being otherwise a function of variety, date of planting, relative level of the land, and the length of time which elapsed between reclaiming an area and planting it up.

From such limited records as are available, I am convinced we shall not be very wide of the mark in placing the average crop for the whole area under cane at about 20 tons per acre. The ratoon crop in places was as low as 15 tons per acre, while the plant cane varied from about 18 tons to as much as 30 tons in certain areas.

The ripening season was a good one, and the canes matured their juice perfectly. Analyses were made at various periods, some results of which appear in Table I.

TABLE I.

Date.	Variety.	Block No.	Brix at 17·5 degrees centigrade.	Sucrose in juice.	Glucose in juice.	Glucose ratio for juice.	Purity co-efficient of juice.	Sucrose on cane.	Remarks.
1	2	3	4	5	6	7	8	9	10.
				Per cent.	Per cent.		Per cent.	Per cent.	
January 10, 1917	Striped Mauritius ratoons	I	19·3	18·55	0·29	1·55	95·9	(15·4)	These ratoons were evidently ready for harvesting at this time, but were not milled till much later in the season, as the factory was not completed.
„ 11, „	B-376 ratoons ...	II	18·3	17·46	0·20	1·17	95·4	(14·5)	
„ 12, „	B-147 ratoons ...	I	18·6	17·22	0·47	2·72	92·2	(14·3)	
January 11, 1917	B-147 plant cane ...	II	16·7	14·47	1·19	8·27	86·5	(12·0)	The plant canes were not at all fully ripe at this time as at the figures show. B-376 and Striped Mauritius were much ripen than B-147 however, and were quite ready for milling in January.
„ 12, „	B-376 „ ...	III	17·7	16·85	0·31	1·84	95·0	(14·0)	
„ 12, „	Striped Mauritius plant cane.	III	18·1	17·0	0·43	2·51	94·0	(14·1)	
February 20, 1917	B-376 ratoons	I	19·0	17·42	0·56	3·2	91·6	(14·5)	These analyses were made on composite samples taken at the factory during the short working period. The figures for percentage of Sucrose on cane were obtained from the analytical figures of the juice and Bagasse, working on basis of 70 per cent. juice and 30 per cent. Bagasse, figures obtained by actual test at the factory mills.
„ 21, „	B-376 and Striped Mauritius ratoons.	I	18·8	17·5	0·4	2·28	93·0	(14·6)	
March 8, „	Striped Mauritius and B-376.	I	19·3	18·49	...	...	95·6	15·4	
„ 9, „	B-147 plant canes ...	V	19·8	17·94	...	...	90·6	14·98	
„ 12, „	Striped Mauritius, B-147 plant.	I, IV and V	19·7	18·0	...	...	91·3	14·06	
„ 14, „	B-147 plant	IV and V	20·4	18·36	...	...	89·8	15·38	

Note on Table I.—It is to be regretted that more analytical data could not be obtained this year. The circumstances were exceptional, as previously explained, and prevented more being done in this connection.

From the figures for analyses made early in January it will be seen that the ratoon canes of all these varieties were at that time of high quality and purity, B-147 being rather less ripe than Striped Mauritius or B-376.

Of the plant canes analysed at the same time, B-376 and Striped Mauritius were ready for milling, and using the conversion factor obtained later by actual test on large quantities of cane and juice, these varieties must at that time have contained at least 14 per cent. of Sucrose on cane. B-147 plant cane was much later than the other varieties in ripening. This is characteristic of that variety, and is of advantage in extending the milling season.

The tests made in February and March, for which figures are given, were carried out on large composite samples obtained at the factory during part of the working season.

The ratoon canes of B-376 and Striped Mauritius had become very slightly over ripe, but were still of high quality.

The plant canes of all three varieties had by early March matured their juice and were very rich in sucrose, averaging about 15 per cent. on cane. Both juice and Bagasse were analysed, and knowing the relative proportions of either derived from crushing a given weight of cane, the figures for sucrose on cane were accurately obtained. From these actual tests, the conversion factor 0·834 was arrived at as the figure by which the per cent. Sucrose in Juice must be multiplied to give per cent. Sucrose on Cane.

Those figures for percentage of Sucrose on Cane which appear in brackets in the table, are the result of using this factor Where the figures do not appear in brackets, they are the results of actual analyses made on both Juice as well as Bagasse.

12. *Extension area, Season*, 1916-17.—Reclamation commenced in the middle of October 1916, and went on into May 1917, the total new area brought under cultivation being 275 acres. In addition 90 acres of land reclaimed last year were reploughed, cultivated, harrowed, drained and trenched. The operations consisted of the harrowing down of grass jungle previous to burning off; ploughing, harrowing, cultivating twice followed by harrowing, draining and trenching for planting. The whole of the area was drained as per scheme described in paragraph 11 of last year's report, previous to planting.

13. *Planting of present crop.*—Planting commenced mid February and was finished by the end of March 1917. In all 260 acres new cane was planted, some 70 acres of this being on land reclaimed 12 months earlier, the remaining 190 acres newly reclaimed. The remaining newly reclaimed land is being kept under cultivation for planting in 1918. The total area under cane this year, plants and ratoon, amounts to just over 500 acres. Germination of the cane planted in February was good; the later planted areas suffered somewhat as a result of the drought which followed in March and April this year. Up to the end of April 1917, only 7 inches of rain was recorded this year against 18 inches in 1916 and 11·5 inches in 1915. Further, the rainfall in May was only 8 inches this year as against 23 and 21 inches in the two previous years.

In the result, on some parts of the newly reclaimed and planted areas, *i.e.*, the lower lying parts, the young plant crop is very thin. Since germination and early growth is very much better on the slightly higher and therefore drier parts of the same areas, the explanation would appear to be that these lower lying areas were, temporarily at any rate, somewhat toxic, and that being newly reclaimed and there having been no heavy rain since reclamation and drainage, the accumulated toxins had not been washed through into the drains and thereby eliminated. That this explanation is correct is suggested by the observed fact that if these lower lying areas are reclaimed, drained and cultivated 12 months prior to planting out, they carry much better crops of cane. Except on the above-noted areas the young crop is doing well to date, more especially where planted early and again on parts of two blocks Nos. V and VI which were reclaimed 12 months previous to planting out, No. VI having been meanwhile green-manured with *Dhaincha* last rains.

On the whole, the crop prospects are not so favourable as they were last year at this time.

The varieties of cane under cultivation are Striped Mauritius and Barbadoes 147 and 376.

14. *Cane Nursery—New Varieties for trial.*—The following varieties were grown in the nursery, (*a*) Red sport of Striped Mauritius; (*b*) Barbadoes 1529; (*c*) Barbadoes A and B (numbers uncertain); (*d*) B-6450; (*e*) B-3412; (*f*) Java 247; (*g*) Java 33*a*; (*h*) White Bombai.

Of these Barbadoes A, B-3412, B-6450 and Java 33*a* and White Bombai showed promise.

All the above, with the exception of B-1529, are being nurseried again this year.

Seven other new varieties have been added this year, making a total of 15 new varieties under trial. They are as follows :—

W. M. Nos. 1; W. M. No. 2 ; W. M. No. 3 ; W. M. No. 4 ; B-208; White Tanna ; Kamrup Red sport of Striped Mauritius.

The varieties showing most promise at present are White Bombai ; W. M. Nos. 2, 3 and 4 ; B-208 ; the local Red sport of Striped Mauritius ; J 33*a* ; Barbadoes A ; B-6450 and B-3412.

15. *Other crops.*—Dhaincha (*Seshania Aculeata*) made a good green manure crop on Block VI, and was ploughed in by the steam tackle in August. It subsequently decomposed perfectly, there being some 21 inches of rain after ploughing in.

Small areas of Dhaincha and Cowpeas (*Vigna Catiang*) were grown for seed on newly reclaimed land. Competition with jungle was severe, and the yield of seed was in consequence small.

No other crops were grown.

Rains crop 1917—5 acres Daincha (*Sesbania Aculeata*) for seed.

16. *Expenditure* :—

From the 1st July 1916 to the 30th June 1917.

KAMRUP SUGARCANE FARM.

Head	From 1st July 1916 to 31st March 1917.	From 1st April 1917 to 30th June 1917.	Total.
1	2	3	4
ESTABLISHMENT.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Manager	7,200 0 0	2,400 0 0	9,600 0 0
Clerks	450 0 0	225 0 0	675 0 0
Compounder	...	90 0 0	90 0 0
Peons	270 0 0	90 0 0	360 0 0
Tackle Assistants	1,770 10 3	615 2 0	2,385 12 3
Additional Establishment	...	135 0 0	135 0 0
Total	9,690 10 3	3,555 2 0	13,245 12 3

Heads.	From 1st July 1916 to 31st March 1917.	From 1st April 1917 to 30th June 1917.	Total.
1	2	3	4
	Rs. a. p.	Rs. a. p.	Rs. a. p.
SPECIAL CONTINGENCIES.			
Implements	498 14 0	3,041 0 0	3,539 14 0
Roads	300 0 0	...	300 0 0
Bricks	3,500 0 0	...	3,500 0 0
Buildings	1,100 0 0	...	1,100 0 0
Weigh-bridge	500 0 0	...	500 0 0
Fencing	...	1,351 8 0	1,351 8 0
Total	5,898 14 0	4,392 8 0	10,291 6 0
REGULAR CONTINGENCIES.			
Feed of Cattle	2,129 14 6	17 8 0	2,147 6 6
Seeds, plants and manures ...	...	7 12 0	7 12 0
Wages of Farm labourers	23,190 1 9	12,842 2 0	36,032 3 9
Petty Repairs	369 10 0	941 13 9	1,311 7 9
Purchase of Furniture	70 0 0	...	70 0 0
Service postage	100 0 0	...	100 0 0
Unspecified Charges	277 10 0	326 3 0	603 13 0
Freight of Machinery	9,600 0 0	3,536 8 0	13,136 8 0
Cost of fuel	736 14 6	4,100 0 0	4,836 14 6
Stores, Oils, etc., ...	806 1 0	529 0 0	1,335 1 0
Total	37,280 3 9	22,300 14 9	59,581 2 6
Grand Total	52,869 12 0	30,248 8 9	83,118 4 9

17. *Staff.*—The present staff consists of :

		Rs.	
	Manager on	800	per mensem.
	Clerk ,, ...	75	,,
Engine staff	One mistri on	55	,,
	Three Engine drivers on ...	22	,,
	Three 2nd drivers ...	18	,,
	Two Engine attendants ...	15	,,
	One godown Mahurrir ...	20	,,
	One Garden Mahurrir ...	25	,,
	One Compounder ...	30	,,
	Three peons on ...	10	,,

18. *General.*—The Chief Commissioner inspected the farm with the Chief Secretary in December 1916.

Other visitors included the Commissioner, Assam Valley Districts, Mr. J. Mackenna, M.A., I.C.S., Agricultural Adviser to the Government of India, Mr. Milligan, Director of Agriculture, Bengal, Dr. Butler, Imperial Mycologist, Dr. Barber, Government Sugarcane Expert, Coimbatore, the Hon'ble Mr. Carter, C.I.E., with Messrs. Dixon and Prentice of Messrs. Turner, Morrison & Co., the Deputy Commissioner, Kamrup, the Conservator of Forests, and Mr. Urmson of Messrs. Kilburn & Co.

The Director of Land Records and Agriculture and the Deputy Director of Agriculture, Assam Valley, visited the farm frequently during the year.

The Manager continued in residence on the farm throughout the year.

The general health has been very good.

KAMRUP FARM,
The 19th July 1917.

A. A. MEGGITT,
Acting Deputy Director of Agriculture, Assam Valley.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN THE UPPER ASSAM VALLEY FOR THE YEAR ENDING 30TH JUNE 1917.

Staff.—Maulvi Fazlul Haq Ahmed, Agricultural Superintendent, was in charge assisted by the Agricultural Inspector, Sibsagar, and four demonstrators. The number of days spent on tour by these officers is as follows :—

Agricultural Superintendent	...	...	255	days.
Agricultural Inspector	...	...	235	„
Demonstrator, Golaghat	...	...	286	„
Demonstrator, Jorhat	...	...	279	„
Demonstrator, Sibsagar	...	...	243	„

The tendency to make frequent returns to headquarters by the demonstrators was very pronounced. Steps have been taken to put a stop to this practice. It is impossible that the demonstrations staff can get into that close touch with cultivators generally, which is so much to be desired if any good is to result, unless they make their tours of a more circular nature, staying overnight in the villages, instead of returning to headquarters so frequently. As an instance of what is meant, it may be mentioned that Demonstrator Anandi Ram Gohain (Golaghat), who spent 104 nights away from headquarters, succeeded in getting 50 manure pits erected during the year. The other two demonstrators, who returned to headquarters much more frequently, only succeeded in arranging for 12 and 4 manure pits, respectively.

2. Demonstrations were continued on :—

Paddy (*a*).—Manuring with Bonemeal and Stane's flour phosphate, combined in certain cases with green manuring.

(*b*) Green-manuring for paddy.

Sugarcane (*a*).—Superior varieties *versus* local canes.

(*b*) Green-manuring for cane.

(*c*) Three roller iron crushing mills.

Potatoes.—Superior varieties—demonstration and sale of.

Meston Ploughs.—Use of.

Conservation of Cattle Manure.—Construction of covered pits.

New crops.—Trials of.

Third year observation of plots manured with bonemeal in **1914.**

3. *Paddy.*—These plots were observed for 3rd year residual effect. The 1st and 2nd year's results appeared in the two previous reports. The 3rd year results are as follows :—

Sibsagar District.

No.	Locality.	Grain in lbs. per acre.		Remarks.
		Bonemeal plots.	Untreated plots.	
1	2	3	4	5
1	Kanugaon	1,230	1,024	Average area of plots was ⅓rd acre.
2	Barkatonee	861	836	
3	Nahorance	1,020	898	
4	Kamargaon	1,506	1,144	
5	Charaibahi	1,199	898	
6	Hatigarh	1,491	1,037	
7	Bogidowl	916	860	
8	Namtiali	1,213	1,133	
9	Amguri	2,083	1,923	
10	Suffrai	1,611	1,586	
11	Pokamura	1,718	1,124	

The average increase per acre of the bonemeal over the untreated plots is 217 lbs grain. Valued at Rs. 3 per maund (82 lbs.), this shows an average net profit of Rs. 7-12 per acre for

the third year. Reference to previous reports will show that the total average net profit per acre for the three years works out at Rs. 17-8, or in other words against an initial outlay of Rs. 9 per acre the cultivator on the average stands to make a net profit of about Rs. 6 per acre per annum for the next three years.

4. *Second year Paddy Demonstrations.*—Commenced in 1915 at 8 centres in the Sibsagar district, one plot at each centre was treated with bonemeal, 3 maunds per acre, the other being a check plot.

The first year's results appeared in last year's report. The 2nd year's outturns were as follows :—

Sibsagar District.

No.	Locality.	Grain in lbs. per acre.		Remarks.
		Bonemeal plots.	Untreated plots.	
1	2	3	4	5
1	Kachojan	Grain pilferred.		Rejected.
2	Parbatia	1,300	780	
3	Khongia	1,054	645	
4	Kakotigaon	1,092	978	
5	Ahomgaon	1293	867	The plots were ⅓rd acre.
6	Gorokhiya-dowl	800	650	
7	Dhaialil	1,425	1,363	
8	Dhaporgaon	885	756	

Average increase due to bonemeal is 258 lbs. grain per acre, valued at Rs. 9-8. Last year the net profit after deducting the cost of bonemeal was Rs. 2-8 per acre. The total net profit for the first two years therefore averages out at Rs. 12 per acre.

5. *New Paddy Demonstrations.*—During 1916, several new centres were added ; at each centre one plot was manured with bonemeal or flour phosphate 3 maunds per acre, the other being a check plot.

Sibsagar District.

No.	Locality.	Grain in lbs. per acre.		Untreated plots.	Remarks.
		Bonemeal plots.	Flour phosphate plots.		
1	2	3	4	5	6
1	Dergaon ...	...	1,263	992	
2	Rhadhola ...	1,185	...	990	Plots were ½rd acre.
3	Parbatia ...	...	1,610	1,240	
4	Murabazar ...	...	1,300	1,176	
5	Betbari	1,550	...	1,125	
6	Langkak ...	2,213	...	1,984	

The average increase due to bonemeal was 184 lbs. grain per acre, of flour phosphate 255 lbs. grain per acre, over corresponding unmanured plots. These results agree with previous experience in the Sibsagar district, *viz.*, that flour phosphate gives a better response than bonemeal for paddy (*vide* report for 1916).

At Rs. 3 per maund for grain, and at a cost for bonemeal and flour phosphate of Rs. 9 and Rs. 8-10 per acre respectively reckoning the whole cost of the manuring against this single crop, this shows a loss of Rs. 2 per acre in the case of bonemeal, and a small net profit of about Re. 1 per acre for flour phosphate.

Though the 2nd and 3rd years crops should, judging from experience, show a good profit, it is to be admitted that the increase of crop in the first year in this district, due to bonemeal or flour phosphate, is not of a sufficiently high order to encourage the cultivator to use these manures. As a rule he cannot wait 2 or 3 years for a return for his money, and generally refuses to look at anything which will not return him at least 100 per cent. on his outlay for manure in the first crop.

If combined with green-manure it is probable that bonemeal or flour phosphate would exert more influence on the first crop. A demonstration on these lines was made during the year, but owing to carelessness on the part of the demonstration staff it ailed.

6. *Sugarcane.*—Seven new demonstrations of superior varieties of cane were made in Sibsagar. The crops were damaged in places by jackals, but in every case our varieties beat the local canes.

The yields of *gur* per acre, average of six centres, were as follows :—

Introduced varieties	4,173 lbs. *gur* per acre.
Local varieties	2,845 lbs. *gur* per acre.

Valuing the *gur* at only Rs 5 per maund of 82 lbs. which is less than its local market value, this shows an average net profit over the local varieties of some *Rs. 100 per acre.*

In three cases the variety demonstrations were combined with experiments in planting methods, and in two cases out of three planting in lines 3 feet apart gave a very considerable increase over the local method of planting in lines about 2 feet apart, which is so close as to prevent proper interculture.

Using the same variety of cane, the average at these three centres was as follows :—

Planted in lines 3 feet apart	4,691 lbs. *gur* per acre.
„ „ „ 2 feet „ (local method) ...	3,637 lbs. *gur* per acre.

Ratoon Canes.—Four demonstrations from last year were ratooned. In all cases again our exotic varieties gave a considerable increase over the local canes, though the average yield of *gur* per acre was low, as the local ryots do not usually ratoon at all, and can only with great difficulty be persuaded to put any trouble or money into a ratoon crop. It is the case also that the Demonstration staff are apt to neglect second year demonstrations, in favour of new work.

The average increase for the four centres in favour of our varieties was some 1,420 lbs. *gur* per acre, valued at Rs. 90 approximately

Green-manuring for Cane.—This was demonstrated at two centres, cowpeas (vigna catiang) being grown and hoed in the year previous to planting. The benefit to the succeeding crop of cane was clearly marked, the check plots being distinctly inferior in growth to the green-manured ones. It also seems to be the fact that under cultivators' conditions our introduced varieties respond better to green-manuring than do the local canes, and this

emphasises the opinion I expressed last year that the ryot must adopt better cultivation methods *pari passu* with the cultivation of better varieties.

The average increase for the two centres in favour of green-manuring was 502 lbs. *gur* per acre, valued at Rs. 31-4, at a cost per acre of Rs. 4-8 for cowpea seed. This is a very favourable result, and agrees with experience of many years' work on the Jorhat Farm.

Three roller iron crushing mills.—Twelve mills were sold in the district, and others were hired out at a nominal rate.

The demand is increasing, as a demonstration never fails to impress cultivators of their value. The capital necessary to purchase, is however generally wanting. At the risk of being wearisome, I must again repeat that there would appear to be a great field for co-operative societies in this connection.

Distribution of cuttings of superior cane varieties.—A fairly large area of cane was grown on the farm at Jorhat to meet the rapidly increasing demand for cane setts, and some 107,000 setts were sent out during March and April. The total number of setts distributed from the Kamrup and Jorhat farms this year, of the three varieties B376, B-147 and Striped Mauritius was some 3¼ lakhs.

Potatoes, Superior Varieties.—Demonstrations were made in six centres. More would have been possible, but for the flood relief work in Nowgong which much reduced the quantity of potatoes available for demonstration purposes, and to meet an increasing demand for sale. At each centre, "Up-to-date" was planted against local bazar seed, and in every case this variety gave an increase over the local one.

The average yields per acre for six centres were as follows:—

For "Up-to-date"	...	...	6,962 lbs. per acre.
„ local varieties	...	...	3,364 „ „ „

This is over 100 per cent. increase in favour of Up-to-date.

Meston Ploughs.—I remarked last year on failure of the demonstration staff to demonstrate this useful, cheap and light plough. On the plea that the cultivators consider the Meston plough too heavy for their small bullocks, demonstration of its usefulness has again been neglected. In many places throughout the district there may be found bullocks big and strong enough for this plough, and one has occasionally heard that buffaloes exist in Assam! Where this plough has been adopted its utility and efficacy are highly spoken of. I look to the Agricultural Superintendent and his staff for a very different report under this head next year.

9. *Conservation of Cattle Manure.*—The construction of model manure pits, covered in, in the villages has been continued. Constant effort being necessary to overcome the conservativeness of the ryots, certain of the demonstrators failed to achieve much. It is much to the credit of Demonstrator Anandi Ram Gohain that he has constructed some 50 manure pits or sheds in his circle, as against 12 and 4 in the other two subdivisions. A little more energy might advantageously be shown by the Agricultural Inspector in respect of the conservation and proper use of cattle manure.

10. *Introduction of New Crops.*—In connection with flood relief work in Nowgong, *boro* paddy (250 mds.), wheat (40 mds.) and potatoes (120 mds.), all practically new crops to the locality, were distributed for seed and every assistance was given to the cultivators, the Agricultural Inspector, Sibsagar, being specially deputed for this purpose. Taking everything into consideration the success attained was quite good.

In one centre an experimental harvesting of *boro* paddy gave 39·5 maunds of unhuskel grain per acre; wheat showed an outturn of 700 lbs. grain per acre.

Potatoes grew well everywhere but were generally ruined by cutworms and red ants previous to harvest. Signs are not wanting that the cultivation of these crops will be carried on and extended in Nowgong; this is receiving every encouragement at our hands. A demonstrator has recently been stationed at Kampur, and it is proposed to locate an Agricultural Inspector in the district shortly.

A. A. MEGGITT,

Jorhat, *Acting Deputy Director of Agriculture,*
Assam Valley.

The 11th August 1917.

REPORT ON THE AGRICULTURAL DEMONSTRATION WORK IN KAMRUP DISTRICT FOR THE YEAR ENDING 30TH JUNE 1917.

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1. *Staff.*—This district forms part of the charge of Maulvi Fazlal Haq Ahmed, Agricultural Superintendent, Assam Valley, who is assisted by Babu Satyendra Chandra Dutt, Agricultural Inspector, Kamrup district, and by two Agricultural Demonstrators who were appointed to Nalbari and Gauhati Circles on the 1st November 1916. During the year the Agricultural Inspector was on tour for 261 days including about four weeks spent, in Bengal and in the Surma Valley, on relief work in connexion with the floods in Nowgong.

2. *Demonstration work.*—This work was continued along similar lines to that of previous years, the main points to which attention was devoted were :—

(1) Manuring and variety demonstration with the rice crop.

(2) Distribution of superior varieties of sugarcane and demonstrations with the three-roller iron sugarcane crushing mills.

(3) Distribution of Shillong potatoes.

(4) Jute demonstrations.

(5) Trial of fodder and miscellaneous crops.

(6) Introduction of improved ploughs.

(7) Conservation of cattle manure.

3. *Manuring of the rice crop.*—(1) This work was started in 1913 but the demonstrations begun in that year have proved of little value during the succeeding years owing to the irregular results given.

Third year demonstrations.—(2) Seven demonstrations manured with bonemeal at 247 pounds per acre in 1914, have been under

observation since; the yields last year were :—

GRAIN PER ACRE IN lbs.

No.	Locality.	Bonemeal plots	Untreated plots.	Remarks.
1	2	3	4	5
1	Rangia	1,070	850	*Ahu* crop only.
2	Septi	212	210	Ditto.
3	Digaru	856	586	Ditto.
4	Chaukhuti	2,376	1,434	Ditto
5	Parakachi	2,146	1,768	*Ahu* and sali.
6	Ajira	1,984	1,694	Sali only.
7	Bilpar	1,770	1,878	Sali only. Part of bonemeal plot injured by disease.

At Chaukhuti the results have been so extraordinarily good for the past two years that one is forced to the conclusion that there must be some special reason operative in that particular place which makes the results inapplicable to the district generally. These figures together with those from the Bilpar centre are therefore disregarded. The average increase from the remaining five centres is 238 lbs. per acre which added to the 120 lbs. obtained in the previous year makes a total increase in two years worth about Rs. 13-8 valuing the paddy at Rs. 3 per maund.

(3) *Second year demonstrations*—These were manured with bonemeal at 247 pounds per acre in 1915. The results were :—

GRAIN PER ACRE IN LBS.

No.	Locality.	Bonemeal plots.	Untreated plots.	Remarks.
1	2	3	4	5
1	Nalbari	722	484	Ahu and sali crops.
2	Gobindpur	982	346	Ditto.
3	Palasbari	1 84	1,192	Sali only.
4	Uparsali	2,330	1,622	Ditto.

Omitting the results of No. 2 centre which appear somewhat doubtful, the average increase per acre comes to 346 lbs. valued at Rs. 13.

As the cost of manuring in the previous year was Rs. 9 and as there was then some increase although not sufficient to pay for the cost of manure, this result may be considered quite satisfactory.

(4) *Second year green manure demonstration.*—A crop of *dhaincha* was grown at these centres in 1915. The yields obtained last year were :—

GRAIN PER ACRE IN LBS.

No.	Locality.	Dhaincha plots	Untreated plot.	Remarks.
1	2	3	4	5
1	Nalbari	2,876	1,622	Aus and sali.
2	Sorbhog	1,754	1,620	Sali only.

These two centres show an average increase, from the use of a *dhaincha* crop in the previous year, of 444 lbs. worth about Rs. 16-8.

(5) *First year demonstrations.*—These were manured with green manure alone and with green manure in conjunction with bonemeal.

GRAIN PER ACRE IN LBS.

No.	Locality.	Green manure plots.	Green manure and bonemeal plots.	Untreated.	Remarks.
1	2	3	4	5	6
1	Tonora ...	708	1,440	672	Sali only.
2	Kuara ...	1,758	1,85	1,484	Ditto.
3	Nalbari ...	1,980	1,942	1,686	Ditto
4	Sorbhog ...	1,832	1,514	1,780	Ditto.

This shows an average increase of 164 lbs. from the green manure. As the increase is worth Rs. 6 and as the expenditure was about Rs. 1-8 this is a promising line of work. The increase of 301 lbs. obtained when bonemeal is used in conjunction with green manures is almost double, but the expenditure is much higher in proportion. The extra crop is worth Rs. 11-4 while the extra expenditure has been only slightly less than that sum. However increased crops may also be expected in the second and third years without any further expenditure.

(6) *Demonstrations with improved varieties of paddy.*—*Indra sali*, a variety introduced by the Bengal Agricultural Department, and *George sali* a variety introduced by Srijut Narayan Barua, Honorary Correspondent, were tested against the local varieties, the yields being as follows:—

GRAIN PER ACRE IN LBS.

No.	Locality.	George sali.	Local sali.	Indra sali.	Remarks.
1	2	3	4	5	6
1	Gobindpur ...	2,856	2,716	2,778	
2	Beltola ...	1,096	1,628	1,702	
3	Nalbari ...	2,112	2,303	1,810	Soil conditions somewhat uneven.

From the average results obtained at the first two centres, both *George sali* and *Indra sali* seem to be heavier cropping varieties than the local kinds. There are indications that water and soil conditions necessary for these varieties differ somewhat, and the work will therefore require to be carried further before conclusions can be drawn.

4. *Demonstrations with superior varieties of sugarcane.*—(1) Six demonstrations were laid down: Two of these had to be given up as the crop was damaged by jackals, the yields of *gur* per acre obtained from the other four demonstrations together

with the outturn obtained from the ratoon crops of the previous years planting at two centres are shown in the following table :—

YIELD OF *GUR* PER ACRE IN LBS.

No.	Locality.	Improved canes.	Local canes.	Remarks.
1	2	3	4	5
1	Changchari	5,808	3,962	
2	Kathiamari	5,188	2,826	
3	Palasbari	4,188	2,558	
4	Gobindpur	4,758	2,818	
5	Parakuchi	3,980	2,772	Ratoon crop.
6	Ditto	892	574	Ditto.
7	Average yields ...	4,134	2,585	

The improved canes used were striped Mauritius, B-147, and B-376 from the Jorhat Farm. There can be no doubt of the superiority of these canes to the local varieties and that this is recognised by the cultivators is evident from the fact that in 1915, 13,000 cane sets were sold and in 1916, 65,000. Thousands more could have been sold had funds been available. In addition to the sets sold at current market rates 14,000 sets were distributed free for demonstration purposes.

(2) *Demonstrations with three roller mills.*—Five three roller cane-crushing mills were used in the district for carrying out demonstrations. The results were so successful that 19 such mills were sold through the seed depôt to cultivators in the Kamrup district.

5. Distribution of Shillong potatoes :—

(1) Five demonstrations were laid down to compare seed potatoes as supplied by the Upper Shillong Farm with local and Khasi mixed seed as ordinarily sold in the bazars.

The yields per acre were :—

No.	Locality.	Shillong seed.	Local seed.
1	2	3	4
		Tons.	Tons.
1	Nankar bhaisa	7·9	3·0
2	Gobindpur	5·6	3·9
3	Sadlipar	6·7	5·6
4	Sorbtog	2·3	1·2
5	Kamalpur	1·5	·9
	Average yields	4·8	2·9

These demonstrations show in every case an increase of crop in favour of the Shillong seed, the average increase per acre being 1·9 tons which valued at Rs. 70 per ton gives an increased money value of Rs. 130 per acre.

(2) Potato spacing demonstration .—

One demonstration was carried out at Khanamukh to test the advantage of planting out potato sets at a somewhat wider spacing than that usually adopted. At this centre, sets planted 24 inches apart gave a crop of 3·3 tons while similar sets planted at 20 inches gave a crop of 2·9 tons.

6. *Jute demonstration.* At Sadlipar Finlow's improved seed was tested against local seed. The result in this case was that Finlow's seed gave an outturn of 2,047 pounds of fibre per acre as against 1,399 pounds from the country seed. This increase of 648 pounds which was worth Rs. 60 to Rs. 70 per acre was a handsome one. The demand for the improved Bengal seed was so great this year that our supply was quite inadequate and many cultivators who wished to use the improved seed had to sow the country seed for another year.

7. Trial of fodder and miscellaneous crops : —

(1) *Jowar* was grown successfully at Nomati and Golindpur and the produce was fed to cattle. A third demonstration at Nalbari failed through the death of the seedlings when they were only a few inches high.

(2) Barley was grown near Nalbari by Srijut Senapati Pathok.

(3) *Boro* paddy was again grown successfully. The demand for seed of *Boro* paddy is increasing yearly.

(4) Ground nuts met with continued success at the few centres at which they were tried.

8. *Introduction of Meston ploughs.*—Demonstrations were carried out successfully in various parts of the district and 23 new ploughs were sold during the season.

9. *Conservation of cattle manure.*—About 20 covered manure pits were erected during the year. These were principally in the Gauhati Circle of the district and credit is due to the demonstrator of that circle to whose exertions this progress is mainly due.

J. W. McKAY,

Camp Karimganj,
The 10th August 1917.

Deputy Director of Agriculture,
Surma Valley and Hill Districts.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN KHASI AND JAINTIA HILLS AND GARO HILLS DISTRICTS FOR THE YEAR ENDING THE 30TH JUNE 1917.

During the year U Harry Singh was in charge of the Demonstration work in the hills. He was assisted by three demonstrators headquartered at Shillong, Mauphlang and Jowai, respectively and by one demonstrator with headquarters at Tura in the Garo Hills.

2. *Rice.*—The majority of rice growers in the district have realised the value of bonemeal for wet-land paddy. Fresh demonstrations have therefore been reduced from 20 in the previous year to 5 in the present year. As in previous years two plots, each about $\frac{3}{4}$ acre in area were taken at each centre. One was manured with bonemeal at the rate of 247 lbs. per acre and the other left untreated as a check.

The first year's results are given in the following table :—

No.	Locality.	Cultivator.	Yield of grain in lbs. per acre.	
			Bonemeal plot.	Untreated plot.
1	2	3	4	5
1	Nongthymmai ...	U Nori	1,506	1,059
2	Lumpyngdeng ...	Hinmuni	1,748	1,100
3	Mawrhop	Kha-i	1,547	1,100
4	Umiap	Ka Nesi	975	543
5	Myriaw	Siem Myriaw ...	1,092	792
		Average yield per acre ...	1,374	919

The average increase in crop due to bonemeal is therefore 455 lbs. per acre. Valuing this grain at Rs. 3 per maund and the bonemeal at Rs. 4-8-0, the net profit per acre works out at Rs. 3-9-0 for the first year of application. Any increase obtained in subsequent years will be pure profit, and experience shows

that bonemeal favourably affects the crop for at least three years. These plots are being kept under observation as to the second and third year's results of the initial dressing of bonemeal.

Second year demonstrations.—The 20 demonstrations laid down in 1915 were kept under observation without further manuring. At four centres the demonstrations were injured by floods, and the results are therefore neglected. The yields obtained at the remaining 16 centres are shown in the accompanying table :—

No.	Locality.	Cultivator.	Yield of grain in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mawsynrie ...	Mrival ...	1,095	660	435
2	Umjapung ...	Klat	1,080	846	234
3	Umsohlang ...	Poet	1,470	975	495
4	Umsaw ...	Biang	1,095	869	226
5	Mawrong ...	Kpa Ka Sen ...	2,040	1,860	180
6	Nonglakhiat ...	Bha	1,140	1,020	120
7	Mawsiatkhnam ...	Kalicharon ...	1,500	1,296	204
8	Untkhah ...	Nimor ...	1,458	978	480
9	Rambrai ...	Hari Siem ...	870	768	102
10	Nongspung ...	Kpa Salihon ...	1,176	975	201
11	Nongwi ...	Kir Lyngdoh ...	1,065	774	291
12	Laitdom ...	Morkin ...	1,218	1,062	156
13	Khlihtyrshi ...	Kpa Manik ...	787	411	376
14	Rymbai ...	Wanbareh ...	611	443	168
15	Kyndongtuber ...	Kpa Kaksel ...	1,110	996	114
16	Mawdymmai ...	Kpa Isaiah ...	1,855	1,308	547
		Average yields ...	1,223	952	271

This average increase of 271 lbs. is worth Rs. 10-2-7 at current prices.

These demonstrations yielded an average net profit of Rs. 4-8 per acre in the first year, after charging the entire cost of bonemeal to that year. The total net profit per acre from the first two years of this series of demonstrations, therefore averages Rs. 14-10-7.

Third year demonstrations.—The ten centres commenced in 1914, of which the first and second years' results appeared in the reports for 1915 and 1916, were kept under observation for the third year. At three centres the demonstrations were injured by floods and are therefore neglected.

The following yields were obtained from the remaining seven demonstrations :—

No.	Locality.	Cultivator.	Yield of grain in lbs. per acre.	
			Bonemeal plots.	Untreated plots.
1	2	3	4	5
1	Lawbyrtun	Suba Myntri ...	728	672
2	Nongkasen ...	Rang Singh ...	1,110	600
3	Pariong	Rison Singh ...	815	744
4	Jakrem	Kourai	1,164	1,133
5	Nongjngi	Hed Doloi	891	779
6	Wahjajer	Ket Phawa ...	939	540
7	Nartiang	U Kat	1,025	942
		Average yields ...	952	773

These seven centres show an average increase of 179 lbs. of grain from the plots manured with bonemeal. This at current rates is worth Rs. 6-12-0. These centres showed an average net profit per acre of Rs. 32-4-0 for the first two years. The total net profit for the three years for which these demonstrations have been carried on is therefore Rs. 30, on an initial expenditure of Rs. 15 per acre.

The trial laid down in 1914 using raw Egyptian phosphate against bonemeal, against no manure was continued for a third year without further manure. In the first year the Egyptian phosphate gave an increase of 150 lbs. of grain per acre, in the

second year a decrease of 36 lbs. per acre and in the past year a further decrease of 33 lbs. per acre. It is clear from this that raw mineral phosphates are less effective than bonemeal under the peculiar soil and climatic conditions of the place. The results of the demonstration are given below :—

Locality.	Cultivator.	Yield of grain in lbs. per acre.		Unmanured.
		Bonemeal plots.	Flour phosphate.	
1	2	3	4	5
Bannium ...	Kpa U Kumoh ...	1,915	825	858

During the year demonstrations with bonemeal for upland paddy were started in 15 centres, five centres being situated in each of the Jowai, Mauphlang and Shillong circles. The selected plots were as nearly as possible 1/10th acre each. One plot was manured with bonemeal at the rate of 247 lbs. per acre and another was left untreated for comparison.

The results for the first year are given in the following table :—

No.	Locality.	Cultivator.	Yield of grain in lbs. per acre.		Remarks.
			Bonemeal plots.	Untreated plots.	
1	2	3	4	5	6
		Khasi Hills.			
1	Mawrah ...	Sabu Roy ...	1,056	650	
2	Marbisu ...	Kpa Honmu ...	447	411	
3	Mawkrieh ...	Kmie U Hadon ...	651	606	
4	Myllicm ...	Ka Jim ...	840	825	
5	Nongkseh ...	U Sami ...	915	312	

No.	Locality.	Cultivator.	Yield of grain in lbs. per acre.		Remarks.
			Bonemeal plots.	Unmanured plots.	
1	2	3	4	5	6
		Khasi Hills—concld.			
6	Umjajen ...	U Hon ...	1,050	603	
7	Bhih	U Nobin ...	732	570	
8	Langlibrin ...	U Sahon ...	879	318	
9	Umsaw Mawtawar	U Sad	687	318	
10	Umshing ...	U Mad Singer ...	...	...	Destroyed by cattle.
		Jaintia Hills.			
1	Um Mawlong ...	Shai Bareh ...	774	674	
2	Pamra ...	Thma	320	256	
3	Tkhiang ...	Doloi	290	248	
4	Syntoo Ksiar ...	Riangmon Shulai ...	348	323	
5	Mih Myntodoo ...	Muni	614	545	
		Average yield ...	686	476	
		Increase ...	210		

As might be expected, the effect of bonemeal on dry land paddy is not so marked in the year of application, as it is in the case of wet-land paddy. From the average results obtained in these 14 demonstrations it will be seen that 247 lbs. of bonemeal has produced an extra crop of 210 lbs. of grain. This is not sufficient to pay the initial cost of the manure.

It is, however, likely that much better results may be obtained in the next and succeeding years, and it is proposed to weigh the produce for two more years.

During the year, at one centre in each of Shillong, Mawphlang and Jowai circles a former demonstration was redressed with bonemeal. These demonstrations were manured with bonemeal in 1914, and received no manure in the intervening

years. The effect of this second dressing of bonemeal will be seen from the accompanying table.

No.	Locality.	Cultivator.	Yield of grain in lbs. per acre.	
			Bonemeal plots.	Untreated plots.
1	2	3	4	5
1	Shangpung	Smon Dhar ...	1,443	754
2	Umlyngka	Kpa Ka Kwai ...	600	483
3	Mairang	Kmie Ka Selina ...	1,464	1,350
		Average yield ...	1,169	862
		Increase per acre ...	307	

These results indicate that a second dressing at the end of the first three years is likely to be profitable. The average increase obtained is almost sufficient to pay the full cost of the manure used, and as similar good results may be expected in the second and third years, this second dressing of bonemeal is likely to give a fair return.

3. *Bone-crushing operations and bonemeal distribution.*—The total receipt of raw bones during the year was 5·41 tons. From this 3·75 tons were ground and produced 3·6 tons of bonemeal. At the commencement of the year there was a balance of bonemeal in stock of ·7 tons, and during the year a consignment of 7·4 tons was purchased in Calcutta and brought to the Jowai district, thus making a supply of 11·7 tons of bonemeal available for distribution in the Hills.

This was distributed as follows :—

	Tons.
Used at the Upper Shillong Farm	·31
For demonstration in the Hills	·25
Exchanged for raw bones	·82
Sold at the Farm	2·52
Sold at Jowai	7·67
Supplied to Honorary Correspondents	·14
Total ...	11·71

4. *Potato growing.*—During the year under report depôts for the sale of seed potatoes were opened at 4 centres, *viz.*:—

	Quantity of potatoes sold. Tons.
(1) Marbisq	·47
(2) Lad Mawphlang	1·22
(3) Dumpep	·45
(4) Jowai	·36
Total ...	2·50

Demonstrations were carried out in two centres in the Jowa subdivision, where this crop is not much cultivated. One maund of seed potatoes was planted at each centre with the following results :—

Locality.	Name of cultivator.	Yield from 80 lbs. of seed.
1	2	3
Nongbah ...	Jakat Pasie ...	477 lbs.
Shangpung ...	Doloi	360 lbs.

The results are promising and the demonstrations are being continued in the present year.

Spraying with Bordeaux mixture.—Ten acres of potatoes were sprayed by the Department's sprayers against two acres in the previous year.

Although considerable damage is done each year to the potato crop by potato blight, the cultivators do not yet fully appreciate the value of spraying as a preventive, and the practice is not adopted to any great extent.

5. *Ploughing demonstrations.*—A ploughing demonstration was carried out at Nongpoh to compare the work done by the small Turn-wrest plough, against that done by the country plough. The costs of labour and yields of crop are recorded below:—

——	Yield of paddy in lbs. per acre.	No of working hours spent on the work.	Rate per day of 8 hours.	Total cost.
1	2	3	4	5
			Rs. a.	Rs. a.
Turn-wrest plough ...	1,920	24	1 14	5 10
Country plough ...	1,560	72	1 12	6 12

The result is encouraging and these demonstrations with the improved plough will be continued.

6. *Insect pests.*—Two kinds of rice pests appeared in the district during the year, *viz*:—Rice fulgroid and rice bugs. Remedial measures were taken by our staff. The ravages of rice fulgroid were successfully checked at four centres by the following means. The water in the affected field was covered with a film of kerosine oil. The insects were then disturbed by drawing a rope or bamboo across the affected plants. When so disturbed these insects drop into the water and are quickly killed by the kerosine oil.

Rice bugs were reported to be seriously injuring the young paddy crops at Umsaijain and Wah Umbah during last year. The Entomological Assistant visited these places and gave instructions for combating the pest by sweeping a bag net over the affected crops. This proved successful.

7. *Grafting of fruit trees.*—This work was continued as in previous years, demonstrations being given by the demonstrators from time to time on their tours. The following grafts were made in 20 villages :—

Oranges	(budded)	829
Pears		565
Peaches		191
Apples		25
Plums		89
Apricots		32
Quince		4
	Total	1,726

Up to the present no signs of disease have appeared on the oranges so budded.

8. *Supply of seeds and plants.*—The following seeds and plants were distributed during the year :—

Garo Cotton seed	4	lbs.
Khaki variety of cotton ...	·25	„
Seed of Shillong pine ...	·05	„
Paddy seed (from Mawsiat Khnam)	56	„
Arrowroots (from Mahadeo) ...	4	„
Coffee seed (ditto) ...	1	„

Seeds of squash	6	number.
Cuttings of Cassava ...	210	„
Ditto black pepper ...	60	„
Ditto Figs	10	„
Orange seedlings	2,279	„
Pomelo	100	„
Lime	550	„
Bitter orange	12	„
Citrus	4	„
Pear grafts	72	„
Pine apple suckers (from Wahjain)	3110	„
Coffee seedlings	160	„

9. *Pan disease.*—The Imperial Bacteriologist, Pusa, visited Shillong and Cherrapoonji and procured diseased specimens of plants for further investigations but no report has yet been received.

Demonstrations in the Garo Hills.

10. During the year potatodemonstrations with winter crop were laid down at four centres. One maund of seed was used in each centre and this was planted on approximately 1/10th of an acre. The yields were as follows :—

Locality.	Yield from 80 lbs. of seed.	Remarks.
1	2	3
	lbs.	
Mahendraganj ...	349	
Dalu	261	
Tura	54	Destroyed by porcupines.
Mukdengra	Nil	Destroyed by wild pigs.

The demonstrations were promising on suitable localities and he work is being continued in the present year.

11. *New demonstrations.*—Demonstrations with Garo cotton are being carried out in three centres in the Jaintia Hills and in one centre at Nongpoh.

Demonstrations with local, well reputed paddy seed are being carried out at 5 centres in the Jowai subdivision.

An additional demonstrator was appointed to the Khasi Hills towards the end of the year. His headquarters will be at Umran and he will work in the districts lying around that place.

J. W. McKAY,

Shillong,

Deputy Director of Agriculture,

The 8th September 1917. *Surma Valley, Assam.*

REPORT ON THE AGRICULTURAL DEMONSTRATION WORK IN THE SURMA VALLEY FOR THE YEAR ENDING THE 30TH JUNE 1917.

Staff.

The demonstration staff in the Surma Valley now consists of, one Agricultural Superintendent—Mr. L. Barthakur who is assisted by —

two Agricultural Inspectors, Babu Benode Behari Das, Agricultural Inspector, Sylhet, and Mr. Lalit Mohan Das who was appointed in August 1916, as Agricultural Inspector, Karimganj and Cachar.

At the commencement of the year we had only one Demonstrator, who was stationed at Karimganj. During the year, five others were appointed, and we have at the end of the present year a Demonstrator for each of the following districts :—North Sylhet, South Sylhet, Habiganj, Karimganj, Cachar, North Cachar Hills.

Kinds of Demonstrations.

2. At the commencement of demonstration work in the Surma Valley there was little to demonstrate, as little previous experimental work had been possible. The work was then practically limited to bonemeal manuring for the paddy crop. During the past two years a small staff has been brought together and these officers are now engaged in demonstrating various agricultural improvements. They have tried the effect of green manuring for the paddy crop and have experimented with limestone on various crops. Improved sugarcane sets from Jorhat have been grown alongside the country varieties. Demonstrations with iron three-roller sugarcane-crushing mills have been carried out. Jute variety and manuring demonstrations have been started. Fodder and miscellaneous rain crops and a variety of cold-weather crops have been tried. In addition to this work, most of the members of our small staff have been engaged for considerable periods, in each of the last two years, in the purchase and distribution of seeds as flood relief.

Bonemeal manuring for paddy.

3. Paddy manurial demonstrations laid down in 1916 were of three kinds (*a*) bonemeal used alone, (*b*) bonemeal used in conjunction with a green crop of *dhaincha*, (*c*) *Dhaincha* used alone. Bonemeal was applied at the rate of 247 pounds per acre and *dhaincha* seed sown at 30 pounds per acre.

The yields were as follows:—

YIELD IN POUNDS PER ACRE.

No.	Locality.	Dhaincha.	Unmanured.	Bonemeal.	Unmanured.	Bonemeal and Dhaincha.	Unmanured.
1	2	3	4	5	6	7	8
1	Yakubnagar	2,226	1,972	2,982	2,762	3,102	1,972
2	Barlekha	1,922	1,710	3,444	2,772	1,694	1,524
3	Ditto	1,916	1,898	...	...	...	...
4	Ditto	1,874	1,804	3,928	2,582	...	...
5	Patharia	2,474	1,340	4,388	3,040	3,448	3,136
6	Ditto	...	...	2,456	2,222	...	...
7	Chotalekha	2,270	1,828	1,804	1,708	...	...
8	Ditto	...	...	2,830	2,032	1,568	1,412
9	Ditto	1,652	1,412	2,336	1,978	...	...
	Average yields	2,333	1,781	2,889	2,642	2,453	2,011
Average increase from manure		552		241		442	
		Rs. a. p.		Rs. a. p.		Rs. a. p.	
Average increase in value at Rs. 3 per maund of 80 pounds.		20 12 0		9 0 0		16 8 0	
Cost of manures, bonemeal at Rs. 3 per maund of 80 pounds, *Dhaincha* at Rs. 5 per maund.		1 12 0		9 0 0		10 12 0	

The average yields obtained from a further eight bonemeal demonstrations which were carried out in Khitta and Kauria parganas Sylhet, were as follows. The plots manured with bonemeal at the rate of 247 pounds per acre gave an average outturn per acre of 2,000 pounds against a yield of 1,626 pounds from the unmanured plots. This means that the application of bonemeal costing Rs. 9 per acre gave an increased outturn worth about Rs. 14 in the first year. Any further increase in the crop in the following years will, of course, add still further to the profits.

4. These demonstrations have been kept under observation since they were laid down. The yields were as follows in the present year :—

Bonemeal demonstrations laid down in 1914 and 1915.

No.	Locality.	Year when demonstration started.	Yield of paddy in lbs. per acre.		Increase on lbs. per acre.			Value of increase.
			Bonemeal plot.	Unmanured plot.	In 1916.	In previous years.	Total increase.	
1	2	3	4	5	6	7	8	9
			lbs.	lbs.	lbs.	lbs.	lbs.	Rs. a. p.
1	Chapghat	1914 ...	3,056	780	2,266	2,714	4,980	86 12 0
2	Barlekha	1915 ...	1,702	1,676	216	52	268	10 0 0
3	Ditto	,, ...	1,978	1,230	748	190	938	35 4 0
4	Pathuria	,, ...	1,028	1,174	—146	278	132	4 14 0
5	Ditto	,, ...	1,800	1,582	218	128	346	12 12 0
6	Ditto	,, ...	3,182	2,388	794	662	1,456	54 4 0
7	Ditto	,, ...	2,710	2,548	162	24	186	7 12 0
8	Ditto	,, ...	2,164	1,746	418	172	590	22 2 0
9	Ditto	,, ...	2,412	3,082	—670	22	—648	—24 8 0
10	Ditto	,, ...	3,174	2,870	304	158	462	17 4 0
11	Ditto	,, ...	2,892	1,296	696	264	960	36 0 0
12	Chotalekha ...	,, ...	1,210	1,026	174	224	398	14 14 0

The results obtained at centres one and nine differ so much from the normal that they are not strictly comparable, and should therefore be left out of consideration. The average increase from the remaining ten centres is worth about Rs. 21-8 per acre when paddy is valued at Rs. 3 per maund. As the expenditure incurred for manure was about Rs. 9 per acre the result is satisfactory.

5. Six demonstrations were laid down in the previous year. In these, slaked lime was applied at the rate of 823 lbs. per acre. There was no noticeable improvement from the use of the lime and no weighings were made.

Slaked lime for the paddy crop on peaty soil.

6. These demonstrations were of two kinds :—(*a*) Introduction of three improved varieties of sugarcane which have proved so successful at Jorhat and in the Assam Valley, *viz.*, Striped Mauritius, B-376 and B-147. (*b*) Introduction of the improved three-roller cane-crushing iron mill.

Sugarcane demonstrations.

With regard to the introduction of the improved varieties which had been commenced in a small way in the previous year, it was found that there was already a marked demand for these canes in those districts were they had been planted in 1915. A total of 15,000 sets were brought from the Khagrabari Sugarcane Farm. Of these 14,000 were distributed free for demonstration purposes and 1,000 sets were sold to cultivators at market prices. The demand was so keen that, had funds been available, very much larger quantities could have been sold.

Our work with the improved three-roller cane-crushing mill has not yet had time to show much effect. One such mill was used for the first time by us in the previous year for demonstration work. In the year under report, five other mills were brought to the valley. Four of these were sold to cultivators and the fifth was used for extending our demonstrations. A large number of demonstrations was carried out to compare the extractions of juice obtained by the three-roller iron mill against that obtained by the use of the ordinary wooden mills. The results obtained from a large number of these experiments show that the iron mills give about 30 per cent. greater extraction of juice, than was obtained by the use of the local wooden mills.

7. Seed of Mr. Finlow's improved variety of jute was distributed to cultivators near Teliapara. The crop was superior to that produced by local seed, but on account of the smallness of our staff it was found impossible to obtain actual weights of fibre. The cultivators were, however, impressed with the superiority of the improved variety of jute, and a large demand for the seed of this variety followed. In the present year a largely increased number of demonstrations has been laid down. Demonstrations on the effect of bonemeal on this crop have also been arranged, and from the promising appearance of the crops at the end of the year under report, useful results are expected.

Jute demonstrations.

Miscellaneous crops.

8. Ground nuts were tried on a small scale at one centre. The soil was of suitable texture, and as it was situated on the slope of a *teela*, it was free from water logging, and consequently the crop grew luxuriantly and yielded well. Ground nuts are saleable at a price varying from Rs. 5 to Rs. 10 per maund, and there would, therefore, seem to be a future for the development of this crop on the higher lands or *teela* slopes.

Jowar was tried in a few centres as a fodder crop. At two centres where the land selected for the experiment was somewhat above the ordinary water-level of the rainy season, fairly good crops were obtained.

At the end of the year under report a larger number of demonstrations of ground nuts, of mixed *jowar* and cowpea for fodder, and of *jowar* alone for the same purpose have been laid down. Ground nuts are very promising where planted on suitable high land, so also are *jowar* and cowpea. These crops will not, however, stand any water logging, and consequently the extension of their cultivation is limited to districts where suitable high land is available.

Extension of cold-weather crops.

9. The injurious flood which took place at the end of the rainy season of 1916 occurred at such a late date, that it was impossible to plant paddy to take the place of the crop which had been destroyed. Under these circumstances it was felt that an attempt should be made to extend the cultivation of cold-weather crops as far as possible. Accordingly arrangements were made to procure seed of such crops as would be likely to grow successfully under the conditions prevailing in the district.

The following quantities of seeds were procured and distributed over those areas where most damage had been done :—

Name of seeds.	Tons.	Value.
1	2	3
		Rs. a. p.
Potatoes	40·25	5,547 8 5
Linseed	14·33	3,120 2 11½
Mustard	9·25	1,416 10 3½

Name of seeds.	Tons.	Value.
1	2	3
		Rs. a. p.
Khesari	5·66	605 3 4
Kalai	3	334 13 11
Gram	2·44	303 13 6
Peas	2·33	305 13 5
Wheat	1·75	209 0 6
Barley	·33	39 8 3
Boro paddy	1·66	196 14 3
Small quantities of *masur*, *mug* and *oats* were also obtained. The value of these was ...	...	81 2 2
Total ...	81·53	12,160 11 0

Oilseeds and potatoes proved the most profitable of these crops from the fact that in most districts they had previously been grown to some extent. The other crops were being introduced into districts where, up to that time, paddy was practically the only crop grown. The agricultural staff was not sufficiently numerous to give necessary and timely instructions about the selection of lands suited to the various new crops, and about the best methods of seeding and cultivation. The consequence was that the crops did not give as good results as were expected. In spite of some failures to obtain a profitable return, this work has been productive of good results in many ways. For instance many cultivators have been accustomed to the idea of growing a food crop in the cold weather—an operation which they had previously not considered or thought possible. Some idea of the proper methods of cultivation of these crops has been gained,

which should make it easier to increase their cultivation in succeeding years. The agricultural officers have come in contact with many people that they would not otherwise have met and should therefore be in a better position to advise and help them in agricultural matters in future.

As the district is liable to frequent floods with the accompanying risk of destruction of the main food crop—rice, it is desirable that additional or alternative food crops should be tested. Accordingly arrangements are being made to carry out experiments with a number of such food crops in the coming cold weather.

Potato growing.

10. In addition to the abovementioned quantity of seed potatoes, a consignment of 3·5 tons of Shillong seed potatoes was sent to Bejoora district in Habiganj. This was sold to cultivators in the district at current market prices, *viz.*, Rs. 5 per maund of 80 lbs. The crop proved highly successful and as a result there is a demand for a very much greater quantity in the coming cold weather.

Demonstration work carried out by Honorary Correspondents.

11. From time to time a number of European and Indian gentlemen who are interested in agriculture have been appointed Honorary Correspondents of the Agricultural Department. The majority of these gentlemen find that they have perhaps little time or opportunity for carrying out experiments, or for encouraging the cultivators in their neighbourhood to give the recommendations of our officers a trial. A few, however, maintain their enthusiasm and give very considerable help to our work in many ways. Among these may be mentioned Babu Joynath Nandy of Bejoora who has steadily encouraged the cultivation of potatoes in his district for several years, and through whose exertions the demand for seed potatoes from that district has now risen to many hundred maunds. Babu Pavitra Nath Das of Beanibazar has carried out many experiments on his own lands and encouraged his cultivators to adopt our recommendations. Messrs. D. Ferguson, Dhamai and J. Lawrie, Akbarpur have assisted us frequently by supplying fruit plants to people desirous of growing them in the province and occasionally to people from outside the province.

J. W. McKAY,

Deputy Director of Agriculture,
Surma Valley, Assam.

SHILLONG :
The 4th September 1917.

GLOSSARY.

Kharif	The rainy season.
Rabi	The cold season.
Ratoon	The second year's sugarcane crop grown from plants put down in the previous year.
Aus	Autumn rice.
Sail	Winter rice.
Asra	A short-stemmed variety of deep water winter rice.
Dhaincha	Sesbania aculeata.
Cowpea	Vigna catiang.
Jowar	Andropogon sorghum var. vulgare
Kalai	Phaseolus mung var. radiatus.
Khesari	Lathyrus sativus.
Musur	Lens esculenta.
Mung	Phaseolus mungo.
Gram	Cicer arietinum.
Coriander	Coriandum sativum.
Radish	Raphanus sativus.
Rape	Brassica Campestris.
Matikalai	Phaseolus mungo var.
Kulthikalai	Dolichos biflores.
Lucerne	Medicago sativa.
Wheat	Triticum vulgare.
Oats	Avena Sativa.
Sugarcane	Sacharum officinarum.
Beer seem	Trifolium alexandrium.
Soy beans	Glycine hispida.
Paddy	Oriza sativa.
Indigo	Indigofera tinctoria,
Groundnuts	Arachis hypogæa.
Sunn Hemp	Crotalaria juncea.
Job's tears	Coir lachryma.
Raishan	Paspalum sanguinale.
Maund	82⅔ pounds.
Jhum	A system of cultivation consisting of paving and burning the surface.

A. S. P. O. (D. L. R. & A.) No. 33—345—21-11-1917.—A. E. R.

ANNUAL REPORT

ON THE

AGRICULTURAL EXPERIMENTS AND DEMONSTRATIONS

IN

ASSAM

FOR THE

YEAR ENDING THE 30TH JUNE 1918.

SHILLONG:
PRINTED AT THE ASSAM SECRETARIAT PRINTING OFFICE.

1918.

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A. S. P. C. (D. L. R. & Agri.) No. 17-345-14-1-1919.—M. C. P.

Annual Report of the Jorhat Agricultural Experiment Station for the year ending 30th June 1918.

1. *Introduction.*—This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most rabi crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented with in culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of the raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag for instance, rather than in the form of acid superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years, in our own experience is clearly detrimental in the absence of periodic lime dressings on sour soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about 35½ acres, of which 1·7 acres is a hola or ravine land and the remainder high land, which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is hola land and the remainder high land.

The total area at present is thus 59½ acres. Most of the newly-added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. *Soil.*—The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth.

The following report is by Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

Report on analysis of Jorhat Farm soil.

	Surface soil.	Sub-soil.
	Laboratory No. 5.	Laboratory No. 5(*a*).
1	2	3
A	Per cent.	Per cent.
Soluble in Hydrocloric acid with 12 *hours' digestion at* 100°*C.*		
Phosphoric acid (P_2-O_5)	0·025	0·020
Potash (K_2-O)	0·115	0·135
Lime (CaO)	0·154	0·144
Magnesia (MgO)	0·166	0·148
B		
Soluble in one per cent. citric acid with 7 days' digestion.		
Phospheric acid	0·008	0·008
Potash	0·007	0·011
C		
Loss on ignition (organic matter and combined water)	3·26	1·84
Nitrogen	0·115	0·051
Calcium carbonate	0·048	0·018
Reaction	Acid	Acid.

Physical constants.

	Hygroscopic capacity.	Maximum water saturation capacity.		Minimum water saturation capacity.		
		Per cent. of water in saturated soil by weight.	Per cent. of water in saturated soil by volume.	Per cent. of water by weight.	Per cent. of water by volume.	
1	2	3	4	5	6	7
Surface soil ...	3·10	31·9	50·5	11·2	13·9	1·3
Sub-soil ...	...	30·0	50·0	7·2	9·1	1·19

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime is quite deficient in quantity.

Carbonate of lime has an enormous influence on a soil's welfare chemically, physically and bacteriologically.

Its effects on soil biological processes are in the right direction and very great; it also influences the texture of soils in a remarkable way, and is active in bringing into use the reserves of dormant plant food. Its presence in fair amount also ensures the most economical effect of any manuring given. Its absence forbids the use, for most cropping, of certain kinds of manures, unless liming be first restored to.

Any upland soil containing such small amounts of total lime and lime carbonate as are here present will most certainly respond markedly in the case of most cropping to applications of lime.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

A good deal of the organic matter present is of a doubtful character and consists very probably of very old residues of little value; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one but in view of the absence in anything like adequate quantity of carbonate of lime,

conditions for nitrification and soil bio-chemical processes generally are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in " total " as well as " available " supplies. There is thus a " real " as opposed to a more temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus, high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself, very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application.

Turning to the physical constants, the hygroscopic capacity is low, and about what one would expect for this class of soil. It means that only water which is in excess of about 3 per cent. is available for crops, and plants are able to reduce the soil moisture content to somewhere about this figure before they begin to wilt. The top 6 inches of soil even during the cold weather normally contains a good deal more moisture than 3 per cent. when under a close standing crop, so that usually there is sufficient water for the crop's requirements.

As regards maximum saturation capacity, these soils agree quite well with quoted figures for similar soils in Europe, and suggest that the optimum proportion of water for the growth of the plant is about 13 to 16 per cent. A recent determination of soil moisture in the surface 6 inches of the soil of this farm in August, some few hours after rain, gave 17 per cent. water. Soil moisture conditions are therefore probably favourable for growth during the rainy season in normal seasons.

The figures for minimum saturation capacity are much lower than those cited (Hall. The soil page 69) for similar soils in Europe, and this is probably due to the lower content of humus which obtains in our soils. This is an extremely important figure in gauging a soil's power to retain a reserve of moisture for crops during dry periods.

The sub-soil is worse in this respect than the surface layer, suggesting that the incorporation of organic matter, if it can be buried sufficiently deep, will have a great ameliorating effect.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crop will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures. No amount or combination of the latter can ever make up the case of a crop like sugarcane for loss of fertility due to shallow cultivation and lack of "humus".

3. *Buildings, machinery, etc.*—The farm is equipped with a godown, combined office and rest house, Farm Manager's bungalow, clerk's and apprentices' quarters, cattle shed, Dutch barn, and is enclosed by "Ideal" wire fencing.

A Hornby oil engine and crushing mill capable of dealing with 1 ton cane per hour was installed in 1911 and has given every satisfaction since.

4. *Rainfall.*—The rainfall recorded during the growing period of the crops referred to is given with the normal rainfall below:—

Month.	Actual rainfall.	Normal rainfall.
1917 April	5·75	8·54
„ May	6·66	9·26
„ June	21·04	11·36
„ July	16·29	14·76
„ August	15·14	15·15
„ September	11·91	9·18
„ October	3·68	4·07
„ November... ...	1·03	0·69
„ December	0·20	0·53
1918 January	0·07	0·93
„ February	0·95	1·32
„ March	7·67	3·90
Total ...	90·44	79·68

Remarks.—The rainfall was some 10 inches in excess of normal, but well distributed, ceasing with a heavy burst on 2nd November 1917. Nice showers fell in the second half of February which enabled us to plant all our cane in good time under nice soil conditions. The spring was colder than usual up to the end of April 1917, but May was hot and rainfall short.

The heavy rains of June and July kept temperature down, but temperatures ran high from August to October.

Cold weather crops were got in well on nice moisture, and did well for a time. The subsequent drought which lasted till February 25th, however, told against them and oats, pulses, etc., were poor in consequence.

5. *Experimental work.*—The work of previous years was continued and extended as follows :—

I. Sugarcane experiments, varietal, manurial, and testing of new varieties.

II. Soil investigations and manurial tests.

III. Trials of new crops or new varieties.

IV. Distribution of improved varieties of sugarcane.

6. *Sugarcane.*—This work includes the testing of varieties, manurial experiments in the cane rotation, trials of different planting methods, and the distribution of the best varieties. Over 1 lakh of cuttings were sent out.

The cane made excellent growth throughout the year and the crops were big. Cold weather fogs, however, commenced early in November and persisted almost throughout the normal ripening season. Heavy wind storms resulted in a good deal of lodging and damage, and to aggravate matters a fungus disease "Malanconium Sacchari" appeared as the canes were ripening. This completely destroyed many canes ; in some varieties the loss was estimated at from 15 to 20 per cent. of the total crop. It is feared that this disease was introduced in a newly acquired variety Java 247, which has since been entirely rooted out and burnt, and all possible steps taken to prevent a recurrence. Injury to other varieties by lodging and borers was probably the cause of their taking the fungus attack, as uninjured unripe canes are reported never to be attacked by this fungus.

Some of the cane yields are therefore lower than they would have been by some 15 to 20 percent, and the quality of the juice is also poorer as a result of the attack than usual.

7. *Sugarcane varieties. Ratoon cane.*—The following varieties planted in Block A in 1916 were ratooned :—B147, B376, Striped Mauritius, Kheri, Magh Magh sport, Barbadoes A and B-6450.

plots of 1/10th acre of each variety being provided on both phosphated and non-phosphated area. The results of the plant cane crop appeared in paragraph 8 of last year's report.

The usual cultivation was given to the ratoons, the common manuring being 2,400 lbs. rape cake, supplying 100 lbs. nitrogen per acre, applied in three equal dressings.

The plots were harvested in February 1918. The results appear in Table I.

Of the older varieties Striped Mauritius and B-376 did well giving about 28 and 25 tons stripped cane per acre. B-147 ratooned badly as compared with previous years, though giving about 19 tons per acre. The following average figures are interesting :—

Variety.	Yield of cane per acre in lbs.	
	Season 1917-18.	Average yield for previous 4 years.
B-147 ratoon ...	42,400	51,640
Striped Mauritius ...	62,400	61,110
B-376 ratoon ...	55,800	52,810

There is thus some indication that B-147 is losing its ratooning capacity which is substantiated by field observations.

Of the newer varieties B-6150 gave a better crop than Barbados A, with much higher sucrose content and a purer juice, comparing very favourably with Striped Mauritius and B-376.

Phosphated area.—The average increase of cane per acre due to application of phosphate was some 3,460 lbs. or 1½ tons. The increase in the previous plant cane crop was 3 tons per acre in favour of the phosphate. Valuing the cane at 5 annas per maund (80 lbs.) this shows a total net profit of Rs. 23 per acre from the use of phosphate in the rotation for the two crops.

TABLE I.

Ratoon cane 1917-18. *Block A.* (*Varieties*).

(Figures are per acre).

Plot.	Variety.	Plot area.	Cane.	Juice.	Expression; juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
			Lbs.	Lbs.	Per cent.	Per cent.	Per cent.		Per cent.	Lbs.	
1	B-147	Acre.	45,760	28,040	61·2	15·02	...	...	87·8	4,212	The (A) plots were on the phosphated area.
1a		$\frac{1}{10}$th ...	39,500	25,400	64·3	14·90	1·00	6·71	86·3	3,785	
2	Striped mauritius ...	$\frac{1}{10}$th ...	59,740	37,370	62·5	...	...	...	...	...	Only partial analysis of these plots was possible this year on account of the claims of other work at the Kamrup Farm.
2a			61,630	38,500	62·5	...	...	...	...	...	
3	B-376	$\frac{1}{10}$th ...	53,340	32,790	61·5	...	...	...	...	...	
3a			60,230	37,550	59·6	...	...	...	...	...	
4	B-147	$\frac{1}{10}$th ...	39,680	25,240	63·6	...	...	...	...	...	
4a			44,690	27,910	62·4	...	...	...	...	...	
5	Striped mauritius ...	$\frac{1}{10}$th ...	57,910	36,890	63·6	...	...	...	...	...	
5a			70,310	44,000	62·6	...	...	...	...	...	

8	B-376 ... — ...	1/5th ...	52,600	34,350	65·3	15·3	0·67	4·42	91·4	6,260
8a			57,000	36,870	64·6	...	...	...	...	...
8	Barbodoes A	1/25th ...	41,630	25,600	61·4	12·3	1·85	15·0	79·8	3,137
7a			52,530	32,580	62·0	...	...	...	...	...
8	B-6450	1/25th ..	57,700	36,940	64·0	...	...	...	...	...
8a			55,630	30,620	63·0	16·05	0·70	4·37	69·8	5,878
9	Magh sport	1/5th ...	24,300	14,120	58·1	13·75	1·09	7·93	83·1	1,042
9a			20,400	11,630	57·0	...	...	...	...	...
10	Magh	1/5th ...	10,700	6,060	56·6	...	...	...	...	...
10a			14,040	6,460	58·5	13·15	1·17	8·89	80·9	850
11	Khori	1/5th ...	72,220	41,320	57·2	11·80	1·91	16·1	76·0	4,876
11a			80,490	44,900	55·8	...	...	...	...	...

8. *Sugarcane varieties. Plant cane. Block* D.—Following the usual rotation this block of cane was green-manured with cowpea (vigna catiang) in 1916 in preparation for cane, part of the block being dressed with 5 cwts. Stane's Flour Phosphate per acre before sowing this crop. At the same time, the whole block was given ground limestone at the rate of 1,600 lbs. per acre.

Rape was sown as a catch crop early in October 1916 and ploughed in while in flower in November. Both the cowpea and rape made much better crops on the phosphated area. The land lay fallow throughout the cold weather. Sugarcane was planted in February 1917, direct into the plots on nice moisture. The following varieties were tested against one another, Striped Mauritius; B-147, B-376, Barbadoes A, B-6450, B-3412, J-33*a*, J-247, Barbadoes B, Magh and Magh sport. Where sufficient planting material was available the varieties were planted on both the phosphated and non-phosphated areas. Common manuring was 40,000 lbs. cowdung per acre, half at planting and the remainder in two equal dressings at either earthing.

The crops all made remarkably good growth and proved on the average the heaviest we have recorded in spite of the attack of "Melanconium Sacchari" referred to in paragraph 6 of this report.

The results appear in Table II.

The figures for cane yield show that the average crop, despite the fungus attack, was a very big one, the average yield per acre for the whole of the varieties being some 33·4 tons per acre, which constitutes a record for this farm.

Thus Striped Mauritius gave 35·7 tons stripped cane per acre; B-376 gave 29 tons; B-147, 26·7 tons; Barbadoes A, 43 tons; B-6450, 32 tons; B-3412, 39·1 tons; J-33*a*, 36·6 tons; Barbadoes B, 35·6 tons; Magh sport 33 tons and Magh, the local variety only 24·4 tons.

TABLE II.

Block D. Plant cane 1917-18. *Varieties.*

Variety.	Plot No.	Plot area.	Cane per acre.	Juice.	Expression; juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.		Per cent.	Lbs.	
B—147	1	1/10th	56,610	38,520	68·0	16·03	0·56	3·51	90·2	6,175	The (a) plots were on the phosphated area.
	1a	"	62,930	43,450	69·0	15·18	0·84	5·56	88·2	6,596	
Striped Mauritius	2	"	83,910	56,130	66·9	14·98	...	...	91·5	8,408	The phosphated plots were much worse attacked by the disease "Melanconium Sacchari" mentioned in paragraph 6, than were the non-phosphated plots. The attack apparently originated in a new variety J—247 which was planted in the centre of the phosphated area, but which was subsequently uprooted and destroyed, thus the results for this variety do not appear in the Table.
	2a	"	75,700	51,800	68·4	14·55	0·83	5·72	88·8	7,537	
B—376	3	"	71,880	46,970	65·3	13·90	0·87	6·31	89·9	6,529	
	3a	"	58,170	39,480	67·8	14·06	0·89	6·34	88·6	5,551	
Barbadoes A	4	"	98,860	66,620	67·4	10·47	2·27	21·68	77·5	6,975	
	4a	"	93,740	64,080	68·3	10·18	2·37	23·28	74·1	6,523	
B—6450	5	"	78,180	51,700	70·7	15·63	0·70	4·49	89·8	8,096	
	5a	"	70,420	48,100	68·3	14·60	0·93	6·41	87·2	7,023	
B—3412	6a	"	87,590	61,880	70·6	11·50	1·92	16·69	78·4	7,116	
J—33a	8a	"	81,970	53,060	64·7	13·06	1·36	10·41	81·7	6,930	
Barbadoes B	9a	"	70,830	53,920	67·5	12·40	1·57	12·66	81·4	6,686	
Magh	6	"	54,830	38,900	70·9	9·85	1·87	18·98	75·9	3,832	
Magh Sport	7	"	74,060	49,350	66·6	13·01	1·10	8·45	84·5	6,420	

The following average figures are interesting :—

Variety.	Yield of cane per acre in lbs.	
	1917-18.	Average yield for 4 previous years.
B-147. Plant cane	59,770	54,255
Striped mauritius	79,805	63,088
B-376	65,025	58,012
Magh	54,830	44,790
Magh sport	74,060	43,780

While the newer varieties Barbadoes A and B, B-6450, P-3412, and J-33*a* gave very high yields of cane, some of them failed to ripen their juice off properly, notably Barbadoes A and B and B-3412 which gave the highest yields of cane. B-6450 was the only one which approached the sucrose content of the older varieties B-147 and Striped Mauritius, etc.

The highest yield of sucrose per acre in expressed juice was returned by Striped Mauritius with 3·5 tons sucrose followed closely by B6450 with 3·37 tons.

Some of these new varieties then have certainly not yet acclimatised themselves to our ripening season here. On the other hand, on the Kamrup Farm where the ripening season is much more favourable than at Jorhat, from analysis made last cold weather, these same varieties appear to ripen off their juice much more perfectly.

Phosphated area.—The phosphated plots in most cases showed a slight decrease in canes fit for milling as compared with the non-phosphated, but otherwise similarly manured plots, a decrease of 2·09 tons per acre on the average. This is explainable on the ground that J-247, the variety in which apparently the fungus disease referred to in paragraph 6 originated, was planted in the centre of the phosphated area, and was not planted in the non-phosphated block. It was observable, and confirmed by subsequent weighment, that the number of canes destroyed by the "Melanconium Sacchari" was much greater in the phosphated area than in the non-phosphated.

9. *Sugarcane planting experiment.—Plant cane.*—Commenced in Block D in 1917. Previous experiments had pointed to the conclusion that the disposition of a given number of cane setts per acre in the trenches at planting time influenced the crop. This experiment provides for testing the value of wide versus narrow trenches on the Java model, and also for testing the value of different disposition of the setts in both cases.

All trenches were 9 inches deep and 5 feet from centre to centre ; in plots 1-4 they were 2 feet wide, while in plots 5 and 6 they were only one foot wide. Eight thousand setts per acre were planted in all plots. Other details are shown in Table III together with the results. The results are too close to permit of any deductions being drawn in regard to either the value of wide versus narrow trenches or the manner of disposition of the setts. It may be more than a coincidence however, that in all cases the planting of the setts in a single row up the middle of the trench gave a higher yield than by disposing them in two spaced parallel rows.

10. *New varieties of cane.*—Four new varieties Barbadoes B, J-33a, J-247 and B-3412 were given field plots this year for the first time. Their behaviour has been dealt with under paragraph 8. On present showing J-33a should make a very good cultivators cane.

Java Hebbal, B-1529 and a red sport of Striped Mauritius received from Coimbatore made a very miserable show in the nursery both as plant cane and ratoons, and have been discarded in consequence.

B-6450 is the most promising of the newer varieties up to date and looks like acclimatising quickly.

Barbadoes A and B-3412, while being very heavy croppers, do not appear to ripen off readily as yet, their juices being low in sucrose and purity.

A number of new varieties have been received in 1918 from the Imperial Sugarcane Expert and other sources and are being propagated in the nursery. These include Co. 1, 6 and 9 ; J-36, 139, 213 ; Ashy Mauritius and Mauritius 55, 90 and 131 ; D74 ; a red sport of Striped Mauritius from Kamrup ; W. M. Nos. 1, 3, 4 and 2 others introduced by Mr. Maxwell into the Kamrup Farm from Java ; White and Red Bombai ; Manjav from Manjri ; and 7 varieties from the Surma Valley.

We are looking for early ripening varieties and three of the above are said to ripen in 10-11 months.

TABLE III.

Block D. Plant cane 1917-18. *Planting experiment.*

Variety.	Plot No.	Method of planting.	Plot area.	Cane per acre.	Juice.	Expression juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
			Acres.	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.		Per cent.	Lbs.	
Striped Mauritius.	1	Java trenches 2 feet wide and 9 inches deep, 5 feet from centre to centre, setts 8,000 per acre planted in a single row up centre of trenches.	$\frac{1}{10}$ ...	69,750	44,700	64·1	14·67	0·93	6·38	88·0	6,558	
	2	Java trenches as in plot 1, but setts 8,000 per acre were disposed in the bottom of the trench in two parallel rows 12 inches apart.	$\frac{1}{10}$ ...	64,880	43,350	66·8	15·18	0·87	5·74	90·7	6,580	
	3	Duplicate of plot 1 ...	$\frac{1}{10}$ ...	67,110	45,330	67·6	15·26	0·85	5·62	89·7	6,918	
	4	Duplicate of plot 2 ...	$\frac{1}{10}$ ...	60,280	40,140	66·6	15·64	0·79	5·05	90·4	6,278	
	5	Java trenches 1 foot wide and 9 inches deep, 5 feet from centre to centre. Setts 8,000 per acre disposed in double parallel rows 6 inches apart.	$\frac{1}{10}$ ...	65,600	45,130	68·7	15·42	...	...	90·6	6,960	
	6	Java trenches as in plot 5, but setts disposed in a single row.	$\frac{1}{10}$ ...	69,000	47,300	68·5	16·06	...	...	90·9	7,597	

11. *Soil investigations and manurial tests.*—The various experiments bearing on this work, mostly having reference to the treatment of sour soils, were continued. Now that my laboratory is completed, and soil investigations are again possible, it is hoped to modify and perhaps extend this work and to place it on a better footing in the near future.

The work includes:—

Block G—Liming experiment commenced 1909.

„ C—Liming and manurial experiment; also an experiment in the use of wood ashes, commenced 1911.

„ K—Experiments to ascertain the reasons underlying the beneficial effect of lime on the old red alluvium, and to test the action of various manures with and without lime, commenced 1912.

„ L—Ground limestone experiment, started 1913.

Blocks E, B, A, D—Experiments in the use of raw mineral phosphate in the sugarcane rotation initiated 1913, 1914, 1915 and 1916, respectively.

For previous details the reports for 1912—1917 may be consulted.

12. *Block G. Liming Experiment.*—Half this block was limed 9 years ago, and both sides are regularly and similarly cropped to see how long the effect of the single lime dressing will last. The cropping this year was jowar in the rains followed by matikalai, oats, gram and rape in the cold weather.

Jowar germinated all over, but very slowly on the unlimed section dying off very shortly after. On the limed side it made about an annas 8 crop.

The cold weather crops germinated all over, but died off within a few weeks on the unitmed section.

On the limed side the gram and rape persisted, but produced no grain, the oats and matikalai did better and yielded a small quantity of grain.

The effect of the lime dressing 9 years ago is thus still marked, though gradually diminishing.

13. *Block C, Lime and Munurial Experiment.*—This experiment, designed to run in the first instance for 6 years, finished its initial course last year. By that time each of the limed sections had received a total of 2 tons of slaked lime per acre either (*a*) as one initial application, or (*b*) as two equal triennial dressings, or (*c*) in six equal annual doses.

As regards cross dressings, each of the phosphated plots had a total of 1,440 lbs. bonemeal, *i.e.*, 240 lbs. annually, for 6 years. Each of the cowdung plots had been given a total of 48,000 lbs. cowdung, *i.e.*, 8,000 lbs. per annum for the 6 years.

It was considered desirable to continue this experiment for residual effect. In deciding on the lines of continuance it was considered that we should distinguish between—

(A) manures used as soil treatment, *i.e.*, those used with a view to more or less permanently improve the soil for all cropping rather than supplying the immediate requirements of any particular crop. In this category we placed lime and bonemeal in view of the probability that the amount of either applied in the previous 6 years may be expected to influence cropping for some years to come, and also it is desirable to measure the residual effect of these two manures; and

(B) other manures, *e.g.*, cowdung, which are more transient or whose effect on the soil are not of such a permanent character. In a hot and humid climate such as ours green-manures would also have to be placed in this category we think.

It was therefore decided—

(*a*) to apply no more lime or bonemeal for the present;

(*b*) to continue green-manuring one block once every four years;

(*c*) to continue the annual cross-dressing of cowdung on sub-plots C and D.

The cropping for 1917-18 was as follows :—

—	Kharif.	Rabi.
1	2	3
Non-green-manured block	Aus paddy ...	Oats.
Green-manured block	Cowpeas for green-manure.	„

Aus paddy should not have been sown on this land in view of our previous experience of the crop. The fact was that we had acquired a small quantity of a specially fine variety of aus paddy which it was desired to grow for seed purposes. It was sown in

lines 2 feet apart; subsequently it was attacked by rice hispa and other paddy bugs, and the resulting crop was in consequence so small and irregular that the yields are of no value.

Cowpeas did well all over except on plot 5A. On the plots cross dressed with bonemeal, *i.e.*, section B, the action of the bonemeal on the green crop was very favourably marked.

The best plots were plots 6, 7, 8, sections C and D. (See Table IV).

The crop was hoed in at the end of July.

As regards the rabi oats crop, in spite of the long drought after sowing, the limed sections made fair to good crops.

The records appear in Table IV.

Lime dressings.—An examination of the figures leads one to the conclusion that, as regards the differential lime applications, the evidence is, as last year, again in favour of the smaller and more frequent dressings, *cf.*, plots 6, 7 and 8 the relative crops being respectively as 154 : 126 : 100, and also plots 2, 3 and 4, the relation being as 140 : 144 : 100. This has been the experience from the 5th year of the experiment to the seventh.

Cross dressings.—In regard to bonemeal, the figures furnish no evidence of the value of this manure to the oats crop. While on the green-manured block the bonemeal plots gave in the aggregate a slightly bigger crop than the plots which had no bonemeal, on the non-green-manured block the result was a small balance against the bonemeal.

Taken over the whole area the crop yielded by the 16 bonemeal plots is almost identical with that yielded by the remaining sixteen, the difference being less than 1 per cent.

Value of organic matter.—The great efficiency of organic manures is strongly emphasized in these results. The aggregate crop of the green-manured block is to that of the non-green-manured area as 129 : 100.

Similarly, for the whole area, the outturn of the 16 plots manured with cowdung is to that of the remaining 16 plots as 229 : 100.

The value then of organic matter is fully apparent, as indeed one would expect it to be in a dry season such as this was, when soils deficient in organic matter are apt to lose moisture so easily.

TABLE IV.

Block C. Seventh year of experiment, 1917-18.

(Figures are per acre) Oats grain.

Cross dressings.	Non-green-manured Block.				Green-manured Block.			
	No lime.	Lime total 4,800 lbs., *i.e.*, 800 lbs. annually for 6 years from 1911-16.	Lime total 4,800 lbs., *i.e.*, 2,400 lbs. in 1911 and again in 1914.	Lime 4,800 lbs. initially in 1911.	No lime.	Lime total 4,800 lbs., *i.e.*, 800 lbs. annually for 6 years from 1911-16.	Lime total 4,800 lbs., *i.e.*, 2,400 lbs. in 1911 and again in 1914.	Lime 4,800 lbs. initially in 1911.
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 5.	Plot 6.	Plot 7.	Plot 8.
1	2	3	4	5	6	7	8	9
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
A. Nil	Nil	400	420	330	Nil	470	530	305
B. Bonemeal 240 lbs. per acre annually 1st to 6th years.	Nil	350	380	260	10	520	430	505
C. Bonemeal 240 lbs. *plus* cowdung 8,000 lbs. per acre annually in 1st to 6th years.	150	890	780	560	710*	1,060	920	530
D. Cowdung 8,000 lbs. annually per acre in 1st to 6th years.	70	860	990	630	470*	1,155	740	740

* *Both these* plots unfortunately received some lime by washing during heavy rain from the heavily limed plots immediately on their left in the early years of the experiment.

14. *Wood ashes experiment.*—Five plots receive respectively 5, 10, nil, 15 and 20 maunds (1 maund=80 lbs.) would ashes per acre per annum. Half of each plot is cross-dressed annually with cowdung 100 maunds per acre. The experiment was commenced in 1911. Cropping this year was cowpea green-manure followed by oats.

The yields of oats were as under:—

		Oats, grain.
	1	2
Plot 1	5 maunds ashes per acre	Nil.
	5 „ „ „ plus cowdung ...	165 lbs.
Plot 2	10 „ „ „	Nil.
	10 „ „ „ plus cowdung ...	210 „
Plot 3	Nil	Nil.
	Cowdung	Nil.
Plot 4	15 maunds ashes per acre...	98 „
	15 „ „ „ plus cowdung ...	434 „
Plot 5	20 „ „ „	375 „
	20 „ „ „ plus cowdung ...	435 „

This is essentially a cultivator's experiment, and shows what can be done towards soil improvement on the old alluvium with wood ashes, especially if supplemented by cowdung. If wood ashes were regularly conserved and applied there can be no possible doubt that cold weather crops, now so conspicuously absent generally in the Assam Valley, could be profitably grown.

15. *Block L. Ground limestone.*—Commenced 1913 on very poor, infertile, newly broken up 'chapri' land. The scheme consists of 6 plots of 1/3rd acre each in two series of 3 plots each. One series Section A is cultivated shallow with country implements; the other section B being worked deeper with English implements. This ensures a deeper application of the limestone on section B than on section A, one of the chief objects of the

experiment being to elucidate the effects of incorporating lime with the soil to varying depths, using a variety of cropping. Ground limestone was applied as follows in 1913 :—

Sections A and B { Plot 1—15 maunds limestone per acre.
„ 2—Nil.
„ 3—30 maunds limestone per acre.

For further details of the scheme see previous years' reports.

The cropping this year, the 5th of the experiment, was a mixed crop of maize and rahar. This same mixture was grown 2 years ago in the 3rd year of the experiment and gave a verdict then in favour of the deeper application of lime, as opposed to the evidence of the wheat and oats crops which have always responded best to its shallower application.

The present crop, maize and rahar, was sown on the 28th April 1917 in drills 4 feet apart. Germination was good all over, and the young plants were early thinned out, maize and rahar alternating in the rows. The crop was kept well cultivated and clean throughout. As opposed to the results of 2 years ago with the same mixed crop, this year section A, shallow cultivation, gave the better results. The seedlings on the unlimed plots of both sections soon began to die out, the maize going first.

The crop led all through on the shallow cultivated section A, otherwise improving with increase in the limestone application on either section. It was well marked throughout the growing period that the difference in favour of section A over section B in the case of the rahar was not nearly so marked as it was in the case of the maize crop. It would appear that rahar is clearly more tolerent of soil acidity than maize, as the latter entirely died out on both unlimed plots, whereas a few stunted rahar plants did struggle through and produced some grain on these same plots. The maize was harvested in August 1917, while the rahar was left for seed, being harvested at the end of April 1918. It is unfortunate that the maize cobs were badly damaged by crows during ripening; the relative weights of grain are thus not reliable. Counts were however made of the number of cobs produced per plot, and again the total crop of each plot was cut and weighed after the cobs were harvested, and the experiment must be judged by these figures, which fully confirm observations made during the growing period.

The rahar flowered late in the cold weather but the seed set badly; during the continued damp weather of March and April the crop was almost entirely ruined by insects or rotted by rain. Though no figures for the rahar crop are available, careful observations made left no doubt that the crops followed the same order as is recorded for the maize.

The figures for the maize crop appear in Table V.

In this the fifth year of this experiment then, *i.e.*, in 1917, we have a reversal of the results obtained with the same crops in the third year, 1915, in regard to the advantage or otherwise resulting from a deeper or shallower lime application. It was clear for both crops, from germination to maturity, that the shallower application gave the better crops this year. Two years ago it was no less clear that the advantage lay with the deeper application. How shall we explain this? In the absence of any recent laboratory examination of the soils of these plots, which has been impossible up-to-date, I cannot advance any adequate explanation. It may, however, be supposed that a repressive degree of acidity will sooner become re-established in the surface soil of section B than in that of section A. While two years ago the soil acidity of plots 1 and 3 in either section, was presumably sufficiently far removed from the danger point to allow of the deeper cultivation acting beneficially, with lapse of time it may well be that at the present time the acidity of the surface soil of the deeply cultivated section is nearer to the danger point for these two crops than is desirable, and that any possible favourable effects of deeper cultivation do not counterbalance this return to acidity.

The teaching of this experiment up to date at any rate appears to be that in the four or five years following the application of ground limestone, (in amounts which do not exceed 100 per cent. of the soils lime requirements to a depth of 3—4 inches), to soils whose surface and sub-strata are both sour, for most farm crops it will pay to keep the limestone well up to the surface by not cultivating too deeply; more especially this applies to shallow rooting crops, *e.g.*, oats and to certain others which root more deeply but which are very susceptible to soil acidity in the seedling stage, *e.g.*, wheat.

This would not appear to apply however with equal force to certain other crops, *e.g.*, rahar, partly on account of deep rooting habits and a comparative tolerance to acidity in its early stages.

The following point also appears to be perfectly clear, that, within the limits of this experiment, the more completely the lime requirements of the soil are satisfied to any given depth the better the growth and development of the crop.

Further, in deciding the depth to which it is advisable to incorporate a given application of limestone with the soil by cultivation, the factor of the susceptibility of the crops to be grown to acidity in the seedling stage is a more potent one than that of depth of rooting.

Finally it is not by any means improbable that had we originally adopted as our maximum dressing of limestone such an amount as would have been equal to 100 per cent. or even 150 per cent. of the soils lime requirement to a depth of 9 or 10 inches, different results might have followed. The investigation of this lies in the future, and will be taken up as time and opportunity permit.

TABLE V.

Block L. Ground limestone experiment. Figures are per plot of 1/3rd acre.

Plot.	Treatment.	Section A (shallow cultivation).			Section B (deep cultivation).			Remarks.
		Total number of maize cobs per plot.	Percentage of cobs bearing grain.	Weight of maize stalks.	Total number of maize cobs per plot.	Percentage of cobs bearing grain.	Weight of maize stalks.	
1	2	3	4	5	6	7	8	9
			Per cent.	Lbs.		Per cent.	Lbs.	
1	15 maunds limestone per acre.	693	19·6	526	104	1	150	Section A plots are cultivated only 3 to 4 inches deep.
2	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Section B plots are cultivated some 6 to 8 inches deep.
3	30 maunds limestone per acre.	1,258	36·8	1,174	900	29·5	924	The result is that any giving dressing of lime becomes incorporated in Section B with twice the volume of soil that it becomes mixed with in Section A.

16. *Block K. Experiment to ascertain the early functions of Lime.*—Commenced in 1912, this experiment was continued in its sixth year. For previous results reference may be made to the Jorhat Farm reports for 1913 *et seq.* and to memoir No. 9, Volume III, Chemical Series of the Memoirs of the Department of Agriculture in India, entitled "Studies of an acid soil in Assam." The experiment is being carried on with a view to throwing further light on some aspects of the use of certain manures, both with and without lime on sour soils.

The evil effects of the continued use of superphosphate, but especially of sulphate of ammonia, on our sour soils, in the absence of lime, are becoming more strongly marked each year. Even green-manure crops, which in the early years of the experiment suffered little if at all from the use of these two manures without lime, are now obviously being adversely affected.

Again though the use of sulphate of ammonia along with lime was at first beneficial, signs are not wanting that unless the lime dressings are renewed, its effects soon begin to be adverse.

Unless the use of lime is periodically resorted to, in our experience on the sour old alluvium of the Assam Valley, it is distinctly not only profitless but detrimental to the soil to use sulphate of ammonia as a source of nitrogen.

Further though this action of sulphate of ammonia is masked to some extent when used as the source of nitrogen in a complete mixture of artificials, it appears from our experiments to be only a matter of time before its baneful effects appear, *i.e.*, if used more or less continuously.

With lapse of time those plots which annually receive cowdung, without any lime, are beginning to yield fair crops of oats. Other experiments on this Farm also go to show that with good cultivation and especially drainage, and the use of bulky organic manures, *e.g.*, green-manures and cowdung regularly, a wonderful improvement can be effected in our sour soils even without the use of lime; however there can be no doubt that it pays well to use lime which has such a favourable effect both on the condition and drainage of many of our sour soils.

The experiment emphasizes as time goes on the lasting value of the basic forms of phosphoric acid, *e.g.*, basic slag and certain raw mineral phosphates.

17. *Blocks E, B, A, and D. Mineral phosphate experiments in the sugarcane rotation.*—An area of about 1 acre in each of the four blocks in the cane rotation, has been dressed with flour phosphate with a view to observing its effect on the various

crops of the rotation. The phosphate is applied in the 4th year of the rotation previous to sowing the green-crop of cowpeas. It will be repeated every fourth year at the same point in the rotation. The rotation is as follows :—Cane in the 1st and 2nd years; a green-crop of dhaincha followed by oats in the 3rd year; a green-crop of cowpeas followed by a catch crop of rape ploughed in, in the fourth year.

It will naturally be some years before very much information will be available; at least we should work through two and preferably three complete rotations on each block before attempting to generalise. So far the rotation has been completed for the first time on two blocks only, *viz.*, blocks E and B. The results for block E appeared in paragraph 17 of last year's report, a net profit of Rs. 39-6 per acre for the rotation being recorded.

On block B, in the year of application, the phosphated area gave an increase of 650 lbs. rape seed per acre over the non-phosphated area, increase valued at Rs. 36. During the first and second years of the rotation there was a slight decrease per acre for the two crops of cane of some 6,500 lbs. per acre valued at Rs. 25-8; (the area to which the phosphate was applied is very difficult to drain properly and from the point of view of the cane crop was much the worst part of the block); in the third year the phosphated area gave an increase of 126 lbs. oats grain per acre valued at Rs. 4-8, neglecting the value of the increased weight of straw obtained also.

The total value of the increase is Rs. 40-8 minus Rs. 25-8= Rs. 15, which almost exactly balances the cost of the phosphate (Rs. 15-12); this, neglecting the value of the increase in oat straw, leaves us as we were in regard to the first rotation on this block.

In paragraphs 7 and 8 of this report will be found an account of the effect of the phosphate on the ratoon and plant cane crop of the year under report.

Block E was the area to get phosphate this year; this is its second application the first dressing having been given in 1913. The crops of cowpeas and rape following made very much quicker growth and bigger crops on the phosphated area.

18. *Extension area.—Block M.*—The indigo of the previous year, after seed harvest, was ratooned as a green-crop and ploughed in; it made a nice even green-crop on the limed area, but did nothing on the unlimed side.

Khasi matikalai was taken as the rabi crop; owing to the cold weather drought it made a poor crop on the limed side, and no crop at all on the other. It was intended to use this block for

trials of various phosphates in a rotation; from the patchy appearance of the crops so far grown, it appears to be very doubtful whether it will ever suitable for experimental work of of an accurate nature.

Blocks O. N. and P. Sugarcane for distribution.—Part of Block O, and the whole of N and P were under cane for distribution some 1,16,000 cane cuttings of B-376, B-147 and Striped Mauritius being sent out during the spring.

The remainder of block O, and block R were under cowpeas followed by matikalai. The yields were as follows:—

—	Grain per acre.
1	2
Block O (dressed with limestone 30 maunds per acre in 1913).	550 lbs. matikalai.
Block R (unlimed).	43 lbs. „

19. *Other crops.*—Block B was green-manured with dhaincha following two years of cane. Oats was taken as the cold weather crop but only yielded poorly on account of the cold weather drought, the outturn being 426 lbs. grain per acre for the phosphated area as against only 300 lbs. for the non-phosphated area.

Cowpea for seed.—Two varieties selected from many in previous years were grown in Block H for seed.

Yields were as follows:—

—	Seed per acre.
1	2
"Jorhat Brown"	890 lbs.
"New Era"	514 lbs.

These yields would have been larger still but for an attack of pod borer which destroyed a large part of the early crop.

Kitchen garden.—A number of crops were grown on small plots of about 1/50th acre for observation, comparison and selec-

tion, *e.g.*, cowpeas (varieties); soy beans (varieties); ground nuts (varieties); dhaincha and sunn hemp for seed; java, natal indigo, etc.

—		Calculated yields per acre; grain.
1		2
Soy beans	Shillong variety	1,223 lbs.
	Farm „	1,098 „
Ground nuts	Farm seed	984 „
	Virginia	640 „
	Big Japan...	376 „
	Raipur	362 „
	Dhaincha	993 „
	Java, natal indigo	2,600 „

Some of these crops were not so good as usual on account of insect attacks and depredations by rats, the ground nut crop in particular was very largely ruined by rats before the nuts were ripe.

Pulse crops.—The following pulses were tried as cold weather crops on plots of about 1/20th acre:—soy beans, musuri, khesari, kulthi and gamhar.

They were sown towards the end of October on nice moisture but the subsequent drought went against them. The results were as follows:—

—	Calculated yield per acre; grain.
1	2
Khesari	636 lbs.
Musuri	335 „
Kulthi	160 „
Soy bean	165 „
Gambar	Failed entirely.

There appears to be good ground for believing that much better results may be expected from these pulse crops by earlier sowing, say mid September. Experiments will be continued with these and other pulse crops. There would appear to be room for a considerable extension of the cultivation of pulse crops in the Assam Valley.

20. *Fodder crops.*—Some attention has been paid during the year to the question of fodder crops suitable for this valley, which is a matter of some urgency, though it is rather much to hope that cultivators will take up seriously the question of fodder supply. We have previously tried various fodder crops, *e.g.*, jowar; maize and cowpeas, euchlœna luxurians, etc., but up-to-date without making any impression on the cultivator.

This year experiments have been commenced with three other crops, *e.g.*, guinea grass, rhodes grass and kheri sugar-cane. Plots of these fodders have been laid down for comparison. Guinea grass was planted up from roots on the 18th June and at the time of writing, August 15th, is ready for first cutting. It appears to be full of promise as a supplier of a large amount of excellent fodder.

Seed of rhodes grass, which is giving such very excellent results on the Military Dairy Farms of Western India, having supplanted guinea grass there, was obtained from Poona. This was grown in seed beds and has only recently been planted out.

Kheri sugarcane was planted up closely in lines in the spring and has already given two cuttings of fodder.

Figures will appear in next year's report. At present the information at our command is insufficient to make any definite recommendations.

21. *Orchard.*—Fruit trees comprise 16 lichis, 6 mangoes, 1 custard apple, 3 sapota, 5 guavas, 1 pomelo, 1 plum and 3 papaya, besides several varieties of plantain, and 12 young orange trees planted during the year. Most fruited well except the mangoes. There are four varieties of pine-apples:—Ceylon, Kew, Queen and Spanish. All fruited well. About 1,000 suckers of the Ceylon and Kew varieties were sent out during the year.

22. *Receipts and Expenditure.*—The receipts from sale proceeds amounted to Rs. 2,585-2. This is somewhat less than last year, chiefly on account of the much lower price obtaining for gur during the crushing season.

The total expenditure including cost of establishment and charges on capital amount amounted to Rs. 11,457-13-1.

23. *Establishment.*—This consists of a Manager on Rs. 100—10—200; clerk on Rs. 25—1½—40 and a peon on Rs. 8. The number of apprentices on the Farm during the year was ten,

two of whom Nozirul Islam Bora and Lalit Nath Kakati proceeded to the Agricultural College, Sabour, in June. Four more completed their training, Umar Ali, Bideshi Ram Dutta, Kesav Narayan Dutta, and Bogai Ram Bora; the three former were appointed temporary demonstrators on 1st November 1917, 1st June 1918, 29th April 1918, respectively.

The following new apprentices joined, Jadab Chandra Das Talukdar and Seyadur Rahman from Goalpara district; Mir Dayam and Puna Ram Keot from Darrang district.

JORHAT:
The 15th August 1918.

A. A. MEGITT,
Agricultural Chemist to the Assam Administration.

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 30TH JUNE 1918.

History and description.

1. The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road, 5½ miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the place is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The total area of the farm is 366·67 acres, of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies in a long narrow valley. The bottom of the valley was formerly a marsh which was of very little value for any purpose, it has recently been converted into firm pasture ground by deepening the stream which drains the valley and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil is of a pronounced reddish colour and of great depth. In a small portion of the cultivated area the soil is black owing, it is believed, to the existence of some mineral compound. At the bottom of the valley, a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having long been under a thick growth of grass, the upper portion of this soil is a matted mass of half-decayed grass-roots.

In point of quality the soil of the farm is extremely poor and very little can be grown on it without the help of manure.

The greater part of the station suffers from the disadvantages of an exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter, the growth of vegetation is entirely suspended.

Purposes of the station.

2. The main objects for which the station is maintained are the trial and introduction of new varieties of potatoes which are the most important among the crops grown on the plateau of the Khasi Hills, the breeding of improved strains of milch cattle suitable for this tract and the cultivation of fodder crops for their up-keep. Fodder experiments have been tried from time to time, but having proved abortive, they have one after another dropped

out of the programme of the farm. Very little experimental work beyond the potato trials is done at present on the farm, and if we leave out the cattle and the fodder crops grown for them, the station may be looked upon more as a seed-growing farm than one devoted to experimental work.

Weather.

3. The following table gives the rainfall during the official agricultural year under report :—

Rainfall.

	Actual, 1917-18.	Normal.	Number of rainy days, 1917-18.
1	2	3	4
1917.			
July	8·66	17·75	18
August	9·58	15·67	15
September	11·35	11·06	18
October	12·66	7·55	9
November	0·56	1·27	1
December	...	0·18	...
Total for six months ...	42·81	53·48	61
1918.			
January	0·15	0·29	1
February	0·45	1·02	3
March	0·33	2·25	1
April	5·18	4·48	7
May	14·55	8·83	20
June	25·64	20·04	23
Total for six months ...	46·30	36·91	55
Total for year	89·11	90·39	116

These 12 months really cover parts of two different agricultural seasons, as, on the plateau of the higher Khasi Hills the cropping season commences in February and ends in November.

The autumn rainfall being rather less than usual was suitable for hay-making and harvesting of the principal crops. Early frosts stopped the growth of winter potatoes and caused this crop to be a light one.

A severe drought in spring checked germination of the potato sets and a period of heavy rainfall in May and June produced conditions favourable to potato disease, with the result that this year's outturn is likely to prove smaller than even the last year's crop.

The other crops will give a smaller outturn than usual. The upland rice, maize and raishan crops are moderate but the Job's tears crop is poor. Owing to the extremely heavy down pour of rain in May and June not only were the crops injured on some of the steep hillsides but considerable damage was done by surface soil being washed away.

Summary of work.

4. The work done during the year included :—

(1) Trials of different varieties of potatoes.

(2) Growing potatoes for seed.

(3) Trials of new crops.

(4) Fodder crops.

(5) Cattle breeding.

(6) Distribution of seeds, implements, etc.

Trials of varieties of potatoes.

5. Of the 22 varieties grown in 1916, Windsor Castle 1909 was given up, and two other varieties Arran Chief and King of Potatoes 1916 have been added. The total number under this experiment in 1917 was thus 23 varieties. Where it was possible, each variety was planted in duplicate plots of $\frac{1}{40}$th acre each. All the varieties were planted in March and harvested in August, and winter seed was used in each case. The land was manured with 11 tons cowdung and 823 pounds of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 240 gallons per acre, applied in two equal doses.

The outturns of each variety in 1917 and in previous years are exhibited in the following table :—

Statement showing the average yield per acre on duplicate plots for the last ten years.

Variety.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last six years.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	
1. King of Potatoes	4·97	9·20	6·33	8·0	6·84	8·58	7·37	4·82	3·51	11·7	7·32	
2. Magnum Bonum (1908)	5·23	9·25	6·77	7·85	6·07	8·51	5·90	4·86	3·22	10·16	7·78	
3. King Edward VII	3·55	7·35	4·61	6·17	4·90	4·58	6·0	2·88	3·31	9·87	5·19	
4. Khasi Naintal	4·12	8·71	5·43	6·93	6·39	6·11	5·78	4·36	4·10	10·7	6·28	
5. Khasi Round	2·89	5·89	4·98	4·52	4·51	4·09	4·95	3·40	3·76	9·35	4·48	
6. British Queen (1909)	4·75	9·12	7·36	7·19	5·60	6·66	6·96	3·40	...	...	6·78	
7. Up-to-Date	4·61	9·76	6·12	7·62	6·84	6·53	5·61	3·30	...	...	6·91	
8. Magnum Bonum (1913)	4·95	8·91	4·93	6·24	5·72	8·22	...	...	...	...	6·49	
9. Windsor Castle (,,)	6·49	10·12	6·20	8·75	4·73	7·19	...	...	...	...	7·24	

Variety.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last six years.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13
10. British Queen (,,)	3·0	7·05	6·19	6·66	5·23	2·66	...	...	...	...	5·28	
11. Flour Ball	2·05	4·54	4·94	5·22	5·9	6·35	...	...	...	...	4·83	
12. Imperator	4·88	7·86	6·84	6·73	6·14	7·74	...	...	...	...	6·69	
13. Magnum Bonum (1915)	2·56	3·34	...	...	...	...	...	...	...	...	2·45	Average for 2 years.
14. Up-to-Date (,,)	3·82	2·16	...	...	...	...	...	...	...	...	2·99	Ditto.
15. Windsor Castle (,, ...	3·96	1·70	...	...	...	...	...	...	...	...	2·83	Ditto.
16. Stirling Castle (,, ...	5·19	2·57	...	...	...	...	...	...	...	...	3·88	Ditto.
17. Epicure (,, ...	3·27	4·71	...	...	...	...	...	...	...	...	3·99	Ditto.
18. Edinburgh Castle (,,)	6·75	2·80	...	...	...	...	...	...	...	...	4·77	Ditto.
19. Dover Castle (,,)	2·42	3·38	...	...	...	...	...	...	...	...	2·90	Ditto.
20. Balmoral Castle (,,)	2·20	2·37	...	...	...	...	...	...	...	...	2·28	Ditto.
21. Acquisition (,,)	4·29	1·28	...	...	...	...	...	...	...	...	2·75	Ditto.
22. Arran Chief	1·32	...	...	...	...	...	...	...	...	...	...	
23. King of Potatoes (1916)	4·92	...	...	...	...	...	...	...	...	...	...	

The same 23 varieties are under experiment in the present year. As in former years, 50 tubers of each variety were selected at random, cut open, and examined for signs of disease. The following table gives the result of the examination in the last eight years :—

Varieties.	Number of diseased tubers out of 50 examined.							
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.
1	2	3	4	5	6	7	8	9
King of Potatoes	12	nil.	nil.	nil.	1	5	3	nil.
Magnum Bonum (1908)	6	4	2	4	2	nil.	1	nil.
King Edward VII (1906)	18	8	4	6	5	4	1	nil
Khasi Naínital (1908)	48	16	8	4	4	8	nil.	1
Khasi Round (1900)	4	8	6	10	6	6	10	3
British Queen (1909)	12	...	6	4	2	8	2	nil.
Up-to-Date (1909)	4	32	16	4	1	6	4	1
Magnum Bonum (1912)	...	...	6	6	2	2	1	5
Windsor Castle (1912)	...	...	4	3	2	10	1	nil.
British Queen (1912)	...	...	4	4	3	6	1	1
Flour Ball (1912)	...	...	6	3	1	10	1	1
Imperator (1912)	...	...	22	3	3	4	3	nil.
Stirling Castle (1915)	...	...	...	...	...	...	10	nil.
Epicure (1915)	...	...	...	...	...	...	5	1
Magnum Bonum (1915)	...	...	...	...	...	...	5	nil.
Dover Castle (1915)	...	...	...	...	...	...	4	1
Up-to-Date (1915)	...	...	...	...	...	...	1	1
King of Potatoes (1916)	...	...	...	...	...	...	...	nil.
Windsor Castle (1915)	...	...	...	...	...	...	2	3
Edinburgh Castle (1915)	...	...	...	...	...	...	3	nil.
Acquisition	...	...	...	...	...	...	...	2
Balmoral Castle	...	...	...	...	...	...	5	3
Arran Chief	...	...	...	...	...	...	...	2

Potato disease caused by Phytophthora Infestans is often responsible for considerable damage to the potato crop in the Khasi Hills. This year the damage to the farm crop was greater than usual, owing to growth being delayed by an early drought, which was followed by rather heavy rainfall in May and June, and an

early appearance of potato blight. Preventive spraying is as thoroughly and systematically carried out on the farm every year as weather conditions permit.

In the present year part of the crop was sprayed twice with Bordeaux mixture, at 120 gallons per acre each time, the balance being sprayed once at the same rate.

Notwithstanding this treatment, growth ceased early, and the crop is yielding a smaller outturn than in the previous year.

Seven new types of potatoes raised from seed in 1914 from the variety Flour-ball have been grown since that time.

Although a certain amount of selection work has been done on these varieties they do not yet seem to be pure. Single plants will be selected in the present year for the purpose of procuring pure strains.

Potato seeds from St. Andrew's University.

Twenty lots of seed were obtained in February 1916 from St. Andrew's University, through the kindness of Donald Ferguson, Esq., of Dhamai Tea Estate, Sylhet, Honorary Correspondent of the Department. Half of each lot of seed was sown in boxes on 20th February 191 , and the remaining half was sown similarly on the 19th March 1916. Out of twenty lots, numbers four and twenty failed to germinate. The others grew satisfactorily, and the seedlings were planted in the field on the 15th March 1916.

Two lots of seed produced only one plant each, and as one of these plants failed to form any tubers, the total number was reduced to nineteen. Two lots were destroyed by insects and the remaining seventeen have given widely varying yields in the past two seasons. Calculating the yields to a uniform amount of one seer of seed of each variety, the outturn has varied from 4 to 56 seers. These varieties are being grown on a larger scale in the present year and it is probable that several good varieties will be found among them.

Potato manurial experiment.—An experiment designed to shed some light on the respective manurial values of rape cake and bonemeal for the potato crop was carried out in 1916 and 1917 and is being repeated in the present year. This experiment was put down in duplicate on a series of plots of King of Potatoes, and a similar duplicate experiment was carried out with

Magnum Bonum. The seed rate was 987 pounds per acre. The manures used and theyields obtained per acre in 1917 are shown in the accompanying table :—

1	2	3	4	5	6	7
Manures used per acre.	Cowdung. 5·5 tons.	Cowdung 5·5 tons, rape cake 823 pounds.	Rape cake 823 pounds.	Bonemeal 823 pounds.	Cowdung 5·5 tons, bonemeal 823 pounds.	Rape cake 823 pounds, Bonemeal 823 pounds.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
King of Potatoes	2·53	4·43	·96	1·19	3·45	1·64
Magnum Bonum	1·13	2·99	1·16	1·52	2·09	1·85
Total ...	3·66	7·42	2·12	2·71	5·54	3·49
Average yield per acre ...	1·83	3·71	1·06	1·35	2·77	1·74

Bonemeal and rape cake were used not because they were considered the most suitable for the potato crop, but because they are practically the only manures, other than cowdung, which are known to the cultivators of the Khasi Hills.

From the yields obtained it would seem that, under the conditions prevailing on the Upper Shillong Farm, while rape cake is more effective than bonemeal as a supplementary dressing with cowdung, yet when used alone, bonemeal gives much better results than the rape cake. These manures are again under experiment in the present season and the results will appear in next year's report.

Potatoes of seed.

6. Six varieties of potatoes were grown during 1917 for the production of seed. These varieties were King of Potatoes, Magnum Bonum, Up-to-Date, Windsor Castle, British Queen and Imperator. The crop was planted in March and harvested in August. The total area planted was 7·4 acres as against 3·1 acres in 1916. The manures used were, as in previous years, 5·5 tons of cowdung, and 823 pounds of rape cake per acre. The crop was sprayed once with

Bordeaux mixture at the rate of 120 gallons per acre. The outturn was as follows :—

Variety.	Area, in acres.	Total yield, in tons.
1	2	3
King of Potatoes	2·35	7·08
Magnum Bonum	2·075	6·29
Up-to-Date	1·325	4·14
Windsor Castle	1·15	4·62
British Queen (1919)	·25	·74
Imperator	·25	1·03
Total	7·4	2·39

The average yield per acre amounted to a little over 3·2 ton against 5·5 tons in 1916.

For the present year about 8 acres have been planted in March with the same 6 varieties. The crop is still in the ground. The demand from the plains for seed potatoes grown on the Shillong Farm is extending rapidly. In order to meet this increased demand, the area under this crop has been extended as far as practicable with the quantity of cattle manure which is available. Even then there is an insufficient supply for the requirements of both hills and plains districts. To still further increase the supply, arrangements were made in 1916 to cultivate an extra area of potatoes under the *Jhum* system and this has been continued since. In that year an area of 16½ acres was planted on the farm lands according to this system, in 1917 10½ acres, and in the current year 10 acres have been so planted.

An agreement was made with Khasi cultivators to carry out this work. The terms were that the farm should provide the land and the seed, and the cultivators should do the work and return to the farm one and a half times the seed supplied. The cultivators also undertake to sell, at bazar rates, whatever additional quantity of seed may be required. In 1917, the farm supplied for this purpose 2·92 tons and in return received 4·77 tons. This included ·36 tons received as payment for the work of spraying the crop with Bordeaux mixture, which was done by the farm workers.

In the present year 10 acres are being cultivated under a similar agreement. The farm supplied 3·78 tons and it is expected that the return will be above 6·06 tons. The total quantity

of potatoes available for disposal last year (1917) was 58·39 tons made up as follows :—

	Tons.
Farm grown crop taking summer and winter crop together	33·03
Seed returned by the *jhum* growers	4·77
Purchased from *jhum* cultivators	20·59
Total	58·39

This quantity was disposed of as follows :—

Sold to Khasi cultivators	11·31
Supplied to Gauhati Seed Depôt and other places in the province through the Agricultural Officers ...	19·45
Sold direct from the farm to officials and private individuals outside the Khasi Hills	1·17
Total quantity supplied for seed ...	31·93
Used on the farm and *jhum* area for planting ...	20·77
Dryage and rottage and feed of cattle ...	5·69
Total	58·39

The price charged to Khasi cultivators for seed potatoes supplied was the market price for table potatoes for the time being and varied last year between Rs. 2-8-0 and Rs. 2-12-0 per maund.

A small quantity of damaged potatoes and potatoes which were unsuitable for seed were fed to the farm stock.

The seed potatoes sold consisted of 9·58 tons of King of Potatoes, 10·72 tons of Magnum Bonum, 3·30 tons of Up-to-Date, 3·85 tons of Windsor Castle and the balance of the minor varieties.

An experiment to test the effect of Bordeaux mixture on young maize plants.

7. It is the custom in many parts of the Khasi Hills to interplant the potato crop with maize. This makes a good combination, but when the time arrives for spraying, the maize plants are in a soft, succulent stage and are easily injured

by the Bordeaux mixture. As a consequence many of the cultivators refuse to spray their potatoes because they hold that the injury to the maize more than counterbalances the benefit to the potatoes.

An experiment was carried out on the farm to test this point.

A plot of $\frac{1}{40}$ acre of maize was sprayed with Bordeaux mixture and a corresponding plot of the same area was left unsprayed The mixture did undoubtedly burn the soft young leaves to some extent, but fresh leaves rapidly shot out and the plants quickly recovered.

When harvesting the maize, the produce of both plots was weighed with the result that the unsprayed plot gave a yield of 2 maunds 13 seers while the sprayed plot gave a yield of 2 maunds 25 seers showing that the temporary check had not reduced the yield of crop.

Warping of rice land.

8. Experiments on the warping of rice land have been carried out on wet rice land for the past few years. As the results were unsatisfactory they have been discontinued in the present year and the land is now being utilized for trials of lime and bonemeal.

The following two series have been laid down :—

First series, Lime experiment.—Duplicate plots of $\frac{1}{10}$th acre each have been manured with lime at the rates of 10 maunds, 20 maunds and 30 maunds per acre, respectively. Four plots remain as control.

Second series, Lime versus *Bonemeal.*—Duplicate plots of $\frac{1}{10}$th acre each have been manured with bonemeal at 3 maunds per acre and another series of duplicate plots with lime at 30 maunds per acre. The rest remain as control plots.

For both experiments, the seed was sown early in May at the rate of 40 seers per acre. When the seed was about to germinate heavy rainfall set in and consequently the germination was unsatisfactory.

Naga Hills rices.—Two varieties of new rice from the Naga Hills, *viz.*, Rhelaw and Thavier, have been introduced for the first time at the farm. These were sown at about the same time on land of ·4 acre. Germination was satisfactory.

New crops.

9. *Buckwheat.*—This crop has been recently introduced into the district by Nepalese settlers, and although the returns have not been very large, it seems to have possibilities on the Khasi Hills, as the cost of cultivation is so small. When the seed is sown immediately after the

potatoes have been dug, no extra cultivation is required. On the farm this course was followed satisfactorily for the first two years of the experiment. In 1915, the crop grew very well until the frosts set in; which unfortunately was rather early in the season. Afterwards little growth was made and the yield was disappointing. The 1916 crop met with a similar fate and was not worth harvesting. Immediately after digging up the potatoes one acre of land was sown with Buckwheat in the middle of July 1917. The crop grew fairly well but as it did not set its flowers uniformly, only about 1 maund 20 seers of seed was gathered. The outturn would have been much greater if the crop had ripened properly.

Rhubarb.—This crop was first planted in 1912, on a plot of land about $\frac{1}{10}$th of an acre in extent. A further plot of $\frac{1}{10}$th of an acre was planted in 1915. The land was manured with cowdung in the winter of 1917-18, at the rate of 11 tons per acre.

The plants grew vigorously and a total of 440 pounds of stalks was sold realising Rs. 55.

The plants are continuing to grow well.

Strawberries.—In September 1916 an additional plot of $\frac{1}{20}$th acre was planted with two varieties of strawberries obtained from the fruit garden, Shillong. These plants grew well and in October 1917 another $\frac{1}{10}$th of an acre was planted with the suckers of these two varieties.

All the plots were manured last winter with cowdung and bonemeal at the rate of 11 tons and 247 pounds, respectively. The strawberry plants are growing well but, owing to the severe spring drought, they flowered late in the season and most of the fruits were destroyed by heavy rains in May.

Only about 8 pounds of fruits have been picked and sold during the year, and the return therefrom was Rs. 5-12.

Other fruits.—A few of the trees on the farm bore fruits. These were sold and realised the following sums:—

	Rs.	a.	p.
Apples	50	13	9
Peaches	0	14	6
Chestnuts	24	9	6
Plums	0	10	0

Fodder crops.

10. The following fodder crops were grown during the year :—

Names of crops.	Area sown.	Cost of cultivation.	Outturn of green fodder.
1	2	3	4
	Acres.	Rs. a. p.	Tons.
Maize	8·62	261 1 3	23·96
Job's tears	12·67	376 8 9	9·76
Jhum area	5 Approx.	...	9·47
Grasses	...	...	16·0
Total	26·29	637 10 0	44·79

The maize crop gave a fair yield. Job's tears did well on the *jhum* area, but the farm crop was poor.

The whole of this fodder (44·79 tons) was made into ensilage. From this quantity of green material 39·95 tons or 80 per cent. was recovered as ensilage of good quality.

The total cost of silage was Rs. 782-6-5, made up of cost of cultivation Rs. 637-10-0, cost of carrying the fodder, chopping, and packing in the silo Rs. 144-12-5.

The proportion of loss through decay around the sides of the pit in which the ensilage was made, was smaller than in the previous year. The cost per ton of silage was Rs. 19-9-0 as compared with Rs. 19-6-0 in the previous year.

Raishan (Paspalum Sanguinale)—has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. Raishan was grown on an area of 12·2 acres and the produce was made into hay and fed to the cattle during the winter months. In addition to Raishan, about 2 acres of soybean and 1·6 acres of hill paddy were grown and the product mixed with the hay.

A total amount of 19·62 tons of hay was fed during the year. The cost was Rs. 638-12-0 or a little over Rs. 32-4-0 per ton of hay as compared with Rs. 34 in 1916.

The quality of this fodder was good, and all was eaten by the cattle.

Cattle breeding.

11. The following table shows the number of cattle in the herd of 30th June 1918 :—

Descriptions.	Montgomery.	Montgomery × Ayrshire.	Montgomery × Patna.	Montgomery × Patna × Bhutia.	M×P×B×P.	M×P×B×P×P.	M×Bhutia.	Patna.	Bhutia (B).	P×B.	P×B×P.	P×B×P×P.	P×B×P×P×P.	P×Khasia (K).	Total on 30th June 1918.	Total on 30th June 1917.	Total on 30th June 1916.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Breeding bulls ...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	2	
Bulls (3 years and above.)	...	1	...	...	...	...	...	1	...	...	2	...	...	2	6	3	4	Are being used as plough cattle.
Bulls (2 to 3 years) ...	1	...	...	...	...	...	...	3	...	...	1	4	...	...	9	7	3	
,, (1 to 2 years) ...	..	...	...	...	...	...	...	5	...	...	...	1	...	...	6	8	9	
,, (under 1 year) ...	...	...	2	2	1	2	...	2	...	...	1	...	...	...	10	6	8	
Heifers (2 to 3 years)	...	...	...	...	...	...	...	8	...	1	1	...	...	...	10	10	9	
,, (above 3 years)	...	...	...	...	...	...	...	3	...	...	1	1	...	...	5	1	...	
,, (1 to 2 years)...	...	...	...	...	...	...	...	3	...	1	1	...	2	...	7	12	6	
,, (under 1 year)	...	...	2	2	2	2	1	1	...	...	2	1	1	...	14	9	12	
Cows	...	...	...	...	...	...	...	13	1	6	5	7	...	...	32	29	25	
Total on 30th June 1918.	2	1	4	4	3	4	1	39	1	8	14	14	3	2	100	...	...	
Total on 30th June 1917.	1	...	...	...	...	...	...	40	1	9	14	15	4	2	...	86	...	
Total on 30th June 1916.	...	...	...	...	...	...	...	38	1	9	14	13	1	2	...	...	78	

In addition to the above, there were three Hindustani and 8 Khasi bullocks. The total number of cattle was therefore 11 against 97 on the corresponding date of last year.

Two young bulls, one a Montgomery and the other an Ayrshire × Montgomery crossbred of 2½ and 3 years old respectively, were purchased for breeding purposes from Pusa Farm during the year.

The demand for bulls bred at the farm still far exceeds the supply. During the past year 5 bulls and 2 heifers were sold. These consisted of one young Patna × Bhutia bull and 2 Patna Bhutia heifers which were sold locally, one Patna bull was sold to the proprietor of the National Dairy, Shillong, one to the Habiganj Municipality, one Patna × Bhutia bull supplied to the Karimganj Farm, and one Patna × Bhutia bull sold to a tea garden Manager in the Assam Valley.

The total yield of milk during the year amounted to 3,487 gallons, out of which about 15 gallons were fed to calves and the remainder was sold at the rate of 14 lbs. for a rupee.

The cost of maintenance of the herd amounted to Rs. 3,015-1-3 against Rs. 3,712-9-8 in the previous year. The income from the sale of milk amounted Rs. 2,101-6-6 against Rs. 1,854 5 6 and the value of the cattle sold to Rs. 223-0-0 against Rs. 327-0-0 in the previous year.

The half English Patna cattle and the progeny of their cross with Khasi and Bhutia breeds have proved remarkably well adapted to the climate of the Khasi Hills. In respect of milking capacity these cattle stand head and shoulders above any cattle on this side of India.

After many years of work we have got together a fine stock of milk cattle, the like of which is not to be seen within many hundred miles of Shillong, and which promises to improve further by selection and crossing. It would be a comparatively easy matter to increase the herd so as to make it possible for us to sell cows and heifers to the public. There is a great demand for female stock bred at Upper Shillong but we cannot afford to sell any at present. Some of our cows might easily fetch Rs. 200 or more, if offered for sale.

The cost of maintaining the herd is still high. It has been reduced considerably in recent years, and it would seem that still further reduction is possible. It might be possible to reduce the expenditure by separating the cows from the rest of the herd and maintaining them purely with a view to profit.

That the Upper Shillong cattle are being more and more appreciated is evident from the growing desire of cow owners in the Shillong Station for the services of the bulls bred on the farm.

The present herd of Patna cattle is far superior to the cattle of the province, and it would undoubtedly be advisable to maintain this breed if that were possible. Several attempts have been

made to obtain young bulls from the Patna district, but owing to the indiscriminate breeding in that district in recent years, it has been so far found impossible to procure bulls of the desired type.

The Montgomery bull which was purchased from the Roman Catholic Mission in the previous year has done good service to the herd. His progeny are stronger and healthier than the young stock we have had for the last few years.

It would be a great mistake to allow the Shillong herd to become mixed by indiscriminate crossing and arrangements are therefore being made to keep the original Patna strain as pure as possible. This may be done by getting a bull from the Patna district or by keeping one of the best of our young bulls as a stud animal.

Distribution of seeds and plants.

12. The following were the seeds and plants supplied to agriculturists during the year :—

	Tons.	Number.
Seed potatoes	31·93	...
Rhubarb roots	...	24
Strawberry plants	...	510
Pear grafts	...	42
Fig cuttings	...	2
Chestnut seedlings...	...	15
* Oilcake for manure	1·80	...

* This was not sold direct from the farm but was recommended and procured for the cultivators.

Establishment.

13. Mr. Harrick Singh continued in the position of Farm Manager during the year. U Shetro Mohan Jyrwa occupied the position of Farm Clerk with effect from the 16th August 1917 in place of U Bendromuney, deceased.

Two apprentices, Gloshon Singh and Sedro Singh, have continued their apprenticeship during the year. In addition to these two apprentices one Khasi and one Garo candidate apprentices are being entertained. These young men work with the labourers and are paid at the ordinary rates.

Receipts and expenditure.

14. The total receipts, including the value of seed potatoes used for demonstration purposes in the province, were Rs. 3,444-12-0 against Rs. 4,516-12-6 in previous year.

The sale of milk produced Rs. 2,001-6-6, the sale of cattle Rs. 226, while potatoes sold direct from the farm realised Rs. 543-13-0, and in addition, potatoes to the value of Rs. 457-9-3 were supplied for demonstration purposes throughout the province. In addition 20·5 tons of seed potatoes to the value of Rs. 1,199-4-6 were purchased from the *jhum* crops grown by Khasi cultivators on the farm and supplied for the plains districts.

The total expenditure for the year amounted to Rs. 14,455-10-11 against Rs. 14,014-7-9 in the previous year. The details are as follows :—

	Rs.	a.	p.
Establishment	2,643	14	10
Petty construction	2,808	14	0
Feed of cattle	2,649	10	9
Seed, plants and manures	513	3	7
Wages of farm labourers	4,486	14	8
Petty repairs	724	5	3
Purchase and repair of furniture	10	0	0
Service postage and telegrams	20	0	0
Unspecified charges			
Purchase of cattle	130	7	6
Total	14,455	10	11

The increase in expenditure was due to two items, *viz.*, (1) a sum of Rs. 1,500 spent on erecting a new cow-shed and new quarters for the apprentices, and (2) a sum of Rs. 1,308-14-0 spent on erecting a permanent wire fence.

CAMP KARIMGANJ,
The 10th August 1918.

J. W. McKAY,
Deputy Director of Agriculture, Assam.

ANNUAL REPORT OF THE FRUIT EXPERIMENT STATION, SHILLONG, FOR THE YEAR ENDING THE 30TH JUNE 1918.

1. *Introductory.*—The Fruit Station commenced work in October 1912 : planting was commenced in the spring of 1913. The land is situated on the south side of the Jowai road, distant about a mile from Shillong. The elevation is about 5,100 feet. The total area of the grant is 57·41 acres, of which about 26 acres is suitable for fruit growing : 24¾ acres have been planted.

2. *Lower Garden.*—No extension to this block has been made since 1913-14. The planted area is 4¼ acres in grounds of 6·13 acres : the fruit trees are planted 15′×15′ diagonally. The soil of this block varies srom light sandy loam lying above stone to heavier loam of good depth. The following varieties on the heavier loam continue to improve in growth and yield—James Grieve, Kerry Pippin, Rymer, Bismarck, Peasgood's Nonsuch, Devonshire Quarrenden, Crimson Bramley, Bramley's Seedling, Lane's Prince Albert. The following varieties yielded sparsely :—Red Juneating, Mr. Gladstone, Warner's King, Scarlet Nonpareil, Alfriston, Yellow Ingestre. Of the others Ribston Pippin, Cox's Orange Pippin, Hounslow Wonder, Hector MacDonald, Cox's Golden Drop, Golden Reinette bore a few fruit ; and Mannington Pearmain, Barnack Beauty, Coronation, Wealthy, Roundway Magnum Bonum, Fearns' Pippin, Rosemary Russet, Newton Pippin did not bear fruit. On the lighter soil only the stronger growing varieties have succeeded, *viz.*—Encore, Bramley's Seedling, Crimson Bramley, Newton Wonder, Lady Sudely, Norfolk Beauty, Potts Seedling, Peasgood's Nonsuch, Alfriston, Lane's Prince Albert, Allington Pippin, Red Victoria, Kerry Pippin, Rymer. Of the varieties planted in place of ones of weaker growth that failed, Rev. W. Wilks, Worcester Pearmain, Bismarck, William Crump, Syke House Russet, Ardcairn Russet, Upton Pyne, Bens Red, promise best : the other varieties planted last year, *viz.*, Grenadier, Star of Devon, Charles Eyre, Lord Derby did not bear fruit.

The Pear trees suffered from the drought in March and April and put on very little new growth. Of the Bushtrees Fertility, St. Swithin, and Fondante Thirriot bore good crops for the size and age of the trees. As far as can be now judged, Fertility is

a great bearer and should be useful for market: St. Swithins an early variety is a prolific bearer, but is small and a poor keeper: Fondante Thirriot is a large white-fleshed pear that promises well for market. Madame Treyve, Durondeau, Beurre d' Amanlis, Emile d' Heyst bore fruit for the first time.

The following Espalier trained trees bore well:—Fondante d' Automne, medium size, flesh very tender and deliciously sweet: Marguerite Marillat—very large, uneven in outline, which did not ripen well this year, William bon Chretien—large melting and of strong musky flavour. [This well known fruit, whose name is freely adopted for any pear, was raised by a school master named Stair of Aldermaston about 1770. In that county it is still called "Stair's Pear", it took its name "Williams" from its distributor, a nurseryman of Turnham Green. On its introduction to America it was again renamed after its importer Mr. Bartlett.] Louise Bonne of Jersey—medium size, a delicious melting white-fleshed pear.

The Cherry trees suffered badly from the drought, and flowering late only a few set on the "Kentish" trees. The "Peregrine" was the only variety of the Peaches that ripened well: first class fruit was picked from the trees from 17th June to 5th July. The "Kestrel" trees bore a good crop, but incessant rain from the 7th to 15th July spoilt them as they were ripening. The 2 exquisite Peach trees bore well for the first time, the fruit ripening at the end of July. The fruit is yellow-fleshed freestone of poor quality compared to the earlier varieties. The other varieties flowered late owing to the drought, and yielded only a few undersized fruits.

The 3 varieties of Plum trees left in this garden for further experiment on light soil, *viz.*, Deniston's Superb Gage, Belle de Louvain, Belgian Purple bore only a few fruit. One of the Langley Bullace trees bore a big crop of dark purple culinary fruit. This variety was raised by Messrs. Veitch (Farleigh Damson X Early Orleans Plum) and introduced in 1902. It is evidently, as described by the raisers, of great fertility and promises to succeed in this climate. The "Merryweather's Damson" trees bore well and the fruit is all the raisers—Messrs. Merryweather and Sons, claim for it; it could readily be mistaken for a late plum until tasted: although the size is so much above that of the largest Damson grown, the true flavour of the Damson is retained. The Giant Himalaya Berry of California and the Blowers are the best of the varieties of Blackberries and the King's Acre Berry the best of the Hybrid Berries. None of the fruit came to perfection owing to the excessive rain in July, when they were

ripening. The Raspberries showed no improvement and have been discarded. White la Versaillaise White Currants fruited and further trials will be made with this variety. The Black Currants transplanted to shady sites have put on good growth but have not fruited. The land has been kept in good cultivation during the year. The lighter soil was again found to be infested with cockchafer grubs necessitating removing the soil round the trees to destroy them. A great many were also killed when the garden was deep hoed. During May and June the cockchafer beetles were caught in thousands by lamp light after dark. Calyx spraying with Arsenate of Lead solution was done, but this may not be the remedy for the grub in the Apple, which Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Pusa, has discovered is the larva of a weevil, an insect that is found on the trees from the time the trees flower, until the mid season fruit ripens. Mr. Bainbrigge Fletcher's report is awaited with interest, as the control of this pest is of the greatest importance in an Apple Orchard. There is also a brown weevil that attacks apple shoots. A boring insect, probably Batocera rubus, is very destructive to Fig trees and although grubs are destroyed as noticed, the damage done eventually kills the tree. There are a great many sucking insects that do damage which will be difficult to control when the trees grow bigger: at present they are caught by hand and destroyed.

3. *Upper Garden.*—The area planted is 20½ acres, of which 10½ acres was planted in 1914, 2 acres in 1915, ½ an acre in 1916, 5¼ acres in 1917, 2¼ acres in 1918. It is divided into 6 blocks, *viz.*:—

Top block.—Area 1¾ acres planted in 1914 with Bush Apple trees 15′ × 15′ diagonally.

North block.—Area 1½ acres planted in 1914 with Standard Apple trees 34′ × 34′ diagonally, interplanted with Bush Apple trees 17′ × 17′.

South block.—Area 5¼ acres planted with Standard Apple trees 30′ × 30′ diagonally, interplanted with Bush Apple, Pyramid Pear, Cherry and Plum trees 15′ × 15′, ¾ acre planted in 1914, ¼ acre in 1915, ½ acre in 1916, 2¾ acres in 1917, 1 acre in 1918.

East block.—Area 8¼ acres; 7 acres is planted with standard Apple trees 34′ × 34′ diagonally, interplanted with Bush Apple trees 17′ × 17′; 5½ acres planted in 1914, 1½ acres planted in 1915. The remaining 1¼ acres was planted in 1918 with Standard Pear trees 25′ × 25′ diagonally.

East block extension.—Area 2½ acres planted in 1917 with Standard Apple trees 30′ × 30′ diagonally, interplanted with Bush Apple trees 15′ × 15′.

West block.—Area 1¼ acres, planted with Standard Pear trees 25′ × 25′ diagonally, interplanted with Bush Pear trees 12′ 6″ × 12′ 6″; 1 acre planted in 1914, ¼ acre in 1915.

The soil of the Upper Garden is a good loam of about 12 inches depth lying on a red sub-soil. Small plots have a hard pan sub-soil about 2½ feet from the surface. The whole of the planted area has been terraced with stone and banks. It has successfully prevented the denudation of the soil by rainfall.

The following statement shows the varieties of the Apples and Pears grafted in 1916 and 1917 :—

Varieties and Stock.	North block.		Top block.		East block.		West block.	
	1916.	1917.	1916.	1917.	1916.	1917.	1916.	1917.
1		3	4	5	6	7	8	9
APPLES GRAFTED ON CRAB STOCK.								
Bismarck	...	245	...	...	40	31	...	...
James Grieve ...	...	827	...	...	78	111	...	...
Kerry Pippin... ...	...	88	...	...	52	76	...	...
Lane's Prince Albert ...	...	...	...	...	15	29	...	...
Rev. W. Wilks ...	...	70	...	104	7	12	10	...
Stirling Castle ...	...	91	...	...	4	8	...	...
Red Victoria... ...	...	...	...	...	7	46	...	...
Crimson Bramley's Seedling.	...	...	...	...	24	36	...	...
Bramley's Seedling ...	...	...	...	...	20	22	...	...
Allfreston	...	...	...	...	40	131	...	...
Rene Red	...	...	...	...	25	56	...	...
Rival	...	...	...	...	48	69	...	...
Domino	...	...	...	...	55	65	...	...
Norfolk Beauty ...	...	83	...	...	...	...	...	...
Total ...	...	1,404	...	104	410	687	10	...

Varieties and Stock.	North block.		Top block.		East block.		West block.	
	1916.	1917.	1916.	1917.	1916.	1917.	1916.	1917.
1	2	3	4	5	6	7	8	9
APPLES GRAFTED ON PARADISE STOCK.								
Bismarck	...	...	...	...	...	65	...	...
James Grieve... ...	...	...	...	...	...	171	...	...
Kerry Pippin ...	...	...	...	...	...	109	...	...
Rev. W. Wilks ...	...	...	...	...	...	72	...	...
Devon Queen... ...	...	...	...	...	...	27	...	...
Barnack Beauty ...	...	...	...	...	...	19	...	...
Ellison's Orange ...	...	...	...	...	...	26	...	...
Total ...	...	...	...	...	...	499	...	...
PEARS GRAFTED ON PEAR STOCK.								
Fertility	...	...	...	...	...	...	47	353
Marquerite Marillat ...	...	...	...	...	...	...	...	43
Fondante Thirriot ...	...	...	...	...	...	...	...	23
Bartlett	...	...	...	...	...	...	...	21
Total ...	...	...	...	...	...	...	47	438
PEARS GRAFTED ON QUINCE STOCK.								
Doyenne du Comice ...	...	...	...	...	...	...	...	98
Madame Treyve ...	...	...	...	...	...	...	...	114
Louise Bonne of Jersey...	...	...	...	...	...	...	...	57
Marquerite Marillat ...	...	...	...	...	...	...	...	79
Fondante Thirriot ...	...	...	...	...	...	...	...	61
Princess	...	...	...	...	...	...	...	67
William's Bon Chretien ...	...	...	...	...	...	...	...	78
Bartlett	...	...	...	...	...	...	...	190
Lincoln	...	...	...	...	...	...	...	11
King Karl	...	...	...	...	...	...	...	6
Howell	...	...	...	...	...	...	...	20
Anjou	...	...	...	...	...	...	...	15
Duchess	...	...	...	...	...	...	...	15
Triumph	...	...	...	...	...	...	...	15
Rousseck	...	...	...	...	...	...	...	6
Total ...	...	...	...	...	...	...	...	861

The following varieties of Apples in this garden have so far yielded best of the Bush trees:—James Grieve, Lane's Prince Albert, Upton Pyne, Bismarck, Rev. W. Wilks, Domino, Sturmer Pippin, William's Favourite, Kerry Pippin, Peasgood's Nonsuch, Lady Sudely, Encore, Bramley's Seedling, Newton Wonder, Charles Ross, Alfriston, Boston Russet, Royal Snow, Wadhurst Pippin, Ecklinville Seedling, Allington Pippin, William Crump, Irish Peach, Lord Grosvenor, Jefferson.

A few varieties of the Standard trees fruited for the first time; the trees have put on good growth. The following varieties of Pears fruited:—Fertility, Princess, Marguerite Marillat, William's bon Chretien, Doyenne d' Ete, Charles Ernest, Dr. Jules Guyot, Durondeau, Beurre d' Amanlis, Colmar d' Ete, Belle Julie, Fondante Thirriot. The trees have put on a better growth than the Lower Garden ones, and the site of the West Block appears to be favourable: the trees are too young to judge as to quality and yield; only the stronger trees were allowed to set a few fruit and these were promising. None of the English Plums bore fruit and growth was poor; the American varieties—Shiro, Gold, Omaha have grown well and bore a few fruits of good quality. None of the Orange trees have yet borne fruit. The whole area of this garden has been kept well cultivated, and the trees have put on very satisfactory growth. The Strawberry crop owing to the drought was a failure. New beds of "Royal Sovereign" have been planted in the South Block. Pruning commenced on the 7th January and was finished on the 12th February. The deep hoeing was finished on the 10th January. Two and quarter acres was added to the planted area this year. The East extension was planted with American and Kashmir Pear trees, and the South extension with Kashmir Apple trees. The whole of the planted area has been fenced with wire fencing.

The following trees are in Nurseries for future planting:—

Description.	South Block 1915 and 1916 trees.	South Block 1917 trees.	East Block 1915 trees from Kashmir.	East Block 1915 and 1916 trees.	Total.
1	2	3	4	5	6
Standard Apple trees ...	175	37	159	260	631
Bush " " ...	...	65	...	...	65
Standard Pear " ...	25	12	1	...	38
Sweet Chesnut ...	6	...	...	...	6
Pecan Nut	9	...	...	...	9

The establishment consists of an Overseer on a monthly salary of Rs. 25, 2 Khasi Apprentices, and Khasi Malis on a monthly salary of Rs. 15 each. All have worked well and take great interest in their work.

4. *Varieties planted.*—The following statement shows the number and varieties of fruit trees planted :—

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	James Grieve ...	59	77	144	58	...	44	382	Bush.
	Boston Russet ...	...	2	12	...	...	...	14	
	Bens Red ...	...	...	10	10	...	9	29	
	Alfriston ...	...	...	29	...	...	8	37	
	Egremont Russet ...	10	...	...	8	1	...	19	
	Annie Elizabeth ...	...	...	20	...	...	...	20	
	Claygate Pearmain ...	8	...	...	10	...	...	18	
	Lord Hindlip ...	...	...	10	...	...	...	10	
	Mannington Pearmain	6	...	...	8	2	4	20	
	Winter Queening of Kent.	...	...	10	...	...	...	10	
	Pineapple Russet ...	...	...	...	9	...	...	9	
	Edward VII ...	...	...	8	...	...	...	8	
	Red Juneating ...	6	...	...	2	...	10	18	
	Flower of Kent ...	...	...	8	...	...	...	8	
	Cornish Pine ...	...	11	...	...	...	...	11	
	Tower of Glamis ...	...	...	...	...	6	...	6	
	Winter Banana ...	...	...	...	...	3	...	3	
	Wolf River ...	...	...	...	...	3	...	3	
	Chelmsford Wonder ...	...	...	...	...	6	...	6	
	Byford Wonder ...	...	...	...	...	10	...	10	
	Ruddy	...	...	...	...	6	...	6	
	Ormead Pearmain ...	...	...	...	...	6	...	6	
	Hambledon deux ans	...	...	...	...	5	...	5	
	Belle de Pontoise ...	...	...	...	...	5	...	5	
	Barnack Beauty ...	...	...	...	6	8	5	19	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Coronation ...	...	...	6	4	...	5	15	Bush.
	Wealthy ...	...	...	...	4	...	6	10	
	Feltham Beauty ...	...	...	10	...	...	...	10	
	Norfolk Beauty ...	8	33	...	10	...	10	61	
	Sanspariel ...	...	3	...	...	...	...	3	
	Guelph	...	1	...	...	...	...	1	
	Peacemaker ...	...	1	...	...	...	...	1	
	Roseberry ...	...	1	...	...	...	...	1	
	Christmas Pearmain...	...	...	10	...	...	...	10	
	Yorkshire Beauty ...	5	...	...	1	...	...	6	
	Kings Acre Pippin ...	...	...	6	...	...	...	6	
	Crimson Bramley ...	15	...	18	...	...	5	38	
	Royal Snow ...	...	...	10	...	...	...	10	
	Bramley's Seedling ...	15	...	15	...	...	14	44	
	Kings of Tompkins County.	1	...	8	2	...	...	11	
	Houblon	...	...	6	...	...	...	6	
	Roundway Magnum Bonum.	6	...	...	...	...	2	8	
	Wellington ...	...	...	5	...	...	...	5	
	Lane's Prince Albert	14	2	17	...	10	11	54	
	Upton Pyne ...	1	3	6	...	...	...	10	
	Devon Queen ...	4	1	2	...	3	...	10	
	Renown	...	4	...	..	6	...	10	
	Stirling Castle ...	10	...	10	...	...	...	20	
	Golden Russet ...	...	...	6	...	...	...	6	
	Charles Ross ...	10	...	10	...	11	...	31	
	Bismarck	...	1	17	8	...	19	45	
	Rymer	6	...	...	...	...	...	6	
	Warner's King ...	...	...	...	...	...	11	11	
	Thomas Rivers ...	10	...	...	...	...	...	10	
	Grenadier ...	...	2	14	...	...	3	19	
	Rev. W. Wilks ...	19	...	6	...	...	6	31	
	Hounslow Wonder ...	...	1	20	...	...	6	27	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple tree ...	Newton Wonder ...	15	...	21	...	...	16	52	Bush.
	Red Victoria ...	...	4	11	...	3	10	28	
	Potts' Seedling ...	4	...	5	...	...	10	19	
	Hector McDonald ...	...	...	20	...	...	10	30	
	Emperor Alexander ...	...	9	...	...	...	...	9	
	Sandringham ...	...	...	...	...	6	...	6	
	Rengemont ...	...	...	...	...	6	...	6	
	Hamblings Seedling...	...	...	...	...	6	...	6	
	Gabalva	...	...	...	...	6	...	6	
	Baron Wolsely ...	...	...	...	...	6	...	6	
	Loddington Seedling	...	...	...	...	6	...	6	
	Parroquet ...	...	...	...	...	6	...	6	
	Domino	13	...	...	...	...	...	13	
	Rival	...	...	16	...	12	...	28	
	Wadhurst Pippin ...	10	...	...	...	...	...	10	
	Court Pendu Plat ...	6	...	6	...	...	...	12	
	Ecklinville Seedling ...	4	...	4	...	...	...	8	
	Early Red Margaret ...	...	...	10	...	...	...	10	
	Gascoyne's Scarlet ...	4	...	5	...	...	...	9	
	Spitzenberg ...	...	...	6	...	...	...	6	
	Braddicks Nonpariel...	5	...	...	...	...	...	5	
	White Nonpariel ...	10	...	...	...	...	...	10	
	Baumann's Reinette...	6	7	8	...	4	...	25	
	Pitmaston Pineapple	10	...	...	...	...	...	10	
	Brownlee's Russet ...	10	...	...	...	...	...	10	
	Sturmer Pippin ...	5	6	16	...	...	20	47	
	Cardinal	...	...	9	1	...	...	10	
	Emneth Early ...	...	3	14	...	8	...	25	
	Langley Pippin ...	...	...	10	...	...	...	10	
	Wagener	...	...	9	...	...	...	9	
	Williams' Favourite...	10	...	...	...	...	...	10	
	Scarlet Nonpariel ...	...	...	10	...	...	12	22	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees	Lord Burghley	1	...	...	...	4	2	7	Bush.
	St. Everard	...	6	...	...	4	...	10	
	Beauty of Bedford	...	4	...	...	7	...	11	
	Reinette doree de Heusgen.	10	...	...	...	...	...	10	
	Coe's Golden Drop	...	...	...	...	...	6	6	
	Cox's Orange Pippin	...	7	...	...	...	23	30	
	Kerry Pippin	...	10	16	...	...	10	36	
	Golden Reinette	...	...	...	...	...	6	6	
	Peasgood's Nonsuch	...	...	25	...	...	14	39	
	Fearn's Pippin	...	...	12	...	...	6	18	
	Lady Sudeley	...	...	20	...	...	10	30	
	Devonshire Quarrenden	...	...	...	...	...	17	17	
	May Queen	...	10	...	...	...	...	10	
	Royal Jubilee	...	10	...	...	...	...	10	
	Missing Link	...	1	...	...	...	...	1	
	Roseberry	...	1	...	...	...	...	1	
	Crawley Beauty	...	1	...	...	...	...	1	
	Mrs. Phillimore	...	...	...	...	6	...	6	
	Lord Grosvenor	...	...	...	...	6	...	6	
	Blue Pearmain	...	...	...	...	4	...	4	
	Jefferson	...	...	...	...	7	...	7	
	Star of Devon	...	...	...	...	20	6	26	
	Yellow Ingestre	...	...	...	...	...	6	6	
	Upton Pyne	...	...	...	...	25	6	31	
	Ardcairn Russet	...	7	5	1	11	5	29	
	Allington Pippin	...	16	5	...	...	4	25	
	William Crump	...	10	19	...	11	6	46	
	Worcester Pearmain	...	...	...	...	...	6	6	
	Herring's Pippin	4	6	3	...	52	1	66	
	Beauty of Bath	...	5	5	...	...	1	11	
	Ellison Orange	...	...	...	...	16	1	17	
	Ribston Pippin	...	4	...	...	...	6	10	
	Charles Eyre	...	...	3	...	10	7	20	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
	Syke House Russet ...	...	...	...	...	...	6	6	Bush.
	Spring Bibston Pippin	...	...	8	...	...	...	8	
	Mr. Gladstone ...	...	...	6	...	...	5	11	
	Golden Spire ...	...	14	...	...	9	...	23	
	Rosemary Russet ...	...	...	6	...	...	6	12	
	Duke of Devonshire ...	...	6	...	...	...	...	6	
	Early Peach ...	...	10	...	...	...	...	10	
	Newton Pippin ...	...	2	8	...	...	6	16	
	American Mother ...	...	9	...	...	...	...	9	
	Encore	...	...	18	...	...	4	22	
	Irish Peach ...	...	6	...	...	...	...	6	
	Lord Stradbroke ...	...	...	...	...	6	...	6	
	Total ...	340	317	792	142	358	432	2,381	
Apple trees ...	Encore	...	6	...	...	...	...	6	Standards.
	Crimson Bramley ...	...	5	3	10	...	...	18	
	Rymer	...	...	...	...	...	8	8	
	Bramley's Seedling ...	...	...	8	12	...	...	20	
	Court of Wick ...	...	...	6	...	...	...	6	
	Irish Peach ...	...	...	...	6	...	...	6	
	Northern Greening ...	...	...	...	...	...	8	8	
	Norfolk Beefing ...	...	...	...	6	...	...	6	
	Newton Wonder ...	...	4	21	...	...	...	25	
	Stirling Castle ...	...	...	5	1	...	5	11	
	Allington Pippin ...	...	...	...	...	...	4	4	
	Annie Elizabeth ...	...	...	...	...	9	...	9	
	Ellison's Orange ...	...	...	...	...	6	...	6	
	Chelmsford Wonder ...	...	...	...	...	6	...	6	
	Lord Grosvenor ...	...	...	...	...	7	...	7	
	Christmas Pearmain ...	...	...	...	...	10	...	10	
	Baldwin	...	5	...	...	...	...	5	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees	Duchess of Oldenburg	...	...	6	...	...	...	6	Standards.
	Norfolk Beaver	...	...	5	1	...	...	6	
	King of Tompkins County.	...	...	6	...	...	...	6	
	Emperor Alexander	...	...	...	6	...	...	6	
	James Grieve	...	3	18	...	...	...	21	
	Cox's Pomona	...	...	2	4	...	...	6	
	Small's Admirable	...	...	6	...	...	...	6	
	New Hawthorden	...	...	5	...	...	...	5	
	Calville St. Saumur	...	7	...	...	...	...	7	
	Reinette de Cuzy	...	8	...	...	...	...	8	
	Precoce David	...	3	...	...	...	...	3	
	Kashmir Amroo	...	3	...	...	...	...	3	
	Fenoillet Gris	...	4	...	...	...	4	8	
	Api Petit	... 1	4	1	...	...	2	8	
	Delicious (Starks)	...	50	12	...	...	...	62	
	King David	...	26	13	...	...	...	39	
	York Imperial	...	...	6	...	...	...	6	
	Paragon Winesap (Starks).	...	...	5	...	...	...	5	
	Jonathan (Starks)	...	2	6	...	...	...	8	
	Black Ben („)	...	20	5	...	...	...	25	
	Stayman Winesap (Starks).	...	...	7	...	...	...	7	
	Senator (Starks)	...	1	4	...	...	...	5	
	Grimes Golden (Starks)	...	12	5	...	...	...	17	
	Sumner Champion (Starks).	...	2	...	...	...	...	2	
	Mother (Starks)	...	...	6	...	...	...	6	
	Emneth Early	...	...	10	...	...	...	10	
	Baumann's Reinette	...	...	10	...	...	...	10	
	Grenadier	...	...	8	...	...	...	8	
	Cox's Orange Pippin	...	...	15	...	...	...	15	

Special of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees	Blenheim Orange ...	...	3	8	...	...	...	11	Standards.
	Calville Blanc ...	...	...	6	...	...	...	6	
	Norfolk Beauty ...	...	15	14	1	...	1	31	
	Reinette du Canada...	...	6	4	...	...	...	10	
	Winter Greening ...	...	8	...	...	...	...	8	
	Rev. W. Wilks ...	...	1	...	...	29	7	37	
	Lord Burghley ...	...	6	...	...	...	...	6	
	Lady Henniker ...	...	4	6	...	...	...	10	
	Golden Spire ...	...	4	4	...	...	...	8	
	Bismarck	...	4	6	...	...	...	10	
	Calville Rouge d'hiver	...	6	...	...	1	...	7	
	Charles Ross ...	...	3	2	...	4	...	9	
	Lord Derby ...	...	...	...	...	...	8	8	
	Barnack Beauty ...	...	...	...	...	6	4	10	
	Herrings Pippin ...	...	3	...	...	16	...	19	
	Rival	...	2	...	...	6	...	8	
	Star of Devon ...	...	...	...	...	4	...	4	
	William Crump ...	...	...	...	...	5	...	5	
	Upton Pyne ...	...	...	...	...	15	...	15	
	Early Melon (Starks)...	...	...	6	...	...	...		
	Wealthy („)...	...	...	4	...	...	...	4	
	Wilson's Red June (Starks).	...	...	6	...	...	...	6	
	Liveland Raspberry (Starks).	...	...	6	...	...	...	6	
	Worcester Pearmain...	...	...	...	...	...	4	4	
	Total ...	1	230	274	47	124	55	731	
	Blenheim Orange ...	...	...	1	11	...	...	12	Horizontal trained.
	James Grieve ...	...	...	...	...	...	4	4	
	Feltham Beauty ...	...	...	2	3	...	...	5	
	Lady Sudeley ...	2	...	...	...	...	3	5	
	Herring's Pippin ...	...	...	2	1	...	2	5	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees	Gascoyne's Scarlet ...	3	...	...	...	...	...	3	Horizontal trained.
	Charles Ross ...	3	...	...	...	...	...	3	
	Brownlees Russet ...	3	...	...	...	...	2	5	
	Baumann's Reinette...	3	...	...	...	...	...	3	
	Beauty of Bath ...	...	...	...	...	...	5	5	
	Sturmer Pippin ...	6	...	...	...	...	...	6	
	Cox's Orange Pippin...	...	...	...	...	...	1	1	
	Cox's Pomona ...	1	...	...	...	...	3	4	
	King of the Pippins ...	...	...	3	...	...	2	5	
	Kerry Pippin ...	...	...	...	...	...	1	1	
	Claygate Pearmain ...	...	...	...	...	...	1	1	
	King of Tompkins County.	...	...	3	...	...	...	3	
	Sterling Castle ...	...	...	...	...	...	3	3	
	Total ...	21	...	11	15	...	27	74	
	Sturmer Pippin ...	...	...	...	3	...	...	3	Upright trained.
	Mannington Pearmain	...	...	...	3	...	...	3	
	Scarlet Golden Pippin	...	...	...	...	...	2	2	
	Washington ...	2	...	2	2	...	...	6	
	Allington Pippin ...	...	...	...	...	...	2	2	
	Golden Spire ...	...	...	1	...	...	...	1	
	Beauty of Bath ...	...	...	...	...	...	2	2	
	Adams Pearmain ...	2	...	...	1	...	...	3	
	James Grieve ...	...	...	...	...	...	2	2	
	King of the Pippins...	...	...	2	1	...	...	3	
	Barnack Beauty ...	...	...	...	...	...	2	2	
	King of Tompkins County.	...	...	...	5	...	...	5	
	Total ...	4	...	5	15	...	10	34	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Charles Ross ...	...	...	6	...	...	...	6	Palmette Verrier trained.
	Rival	...	...	5	...	...	...	5	
	James Grieve ...	...	...	6	...	...	...	6	
	Blenheim Orange ...	...	...	6	...	...	...	6	
	Total ...	...	...	23	...	...	...	23	
	Baumann's Reinette...	...	4	...	...	...	...	4	Fan trained.
	Golden Spire ...	...	1	...	...	...	...	1	
	Total ...	...	5	...	...	...	...	5	
	Rival	...	...	3	...	...	...	3	Double Cordon.
	Total ...	...	...	3	...	...	...	3	
	Rival	...	...	3	...	...	...	3	Single Cordon.
	Total ...	...	...	3	...	...	...	3	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	West block.	South block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
Pear trees	Fertility ...	..	53	1	...	18	72	Bush and Pyramid.
	St. Swithins ...	...	...	...	...	10	10	
	Beurre Hardy ...	...	17	1	2	...	20	
	Red October ...	...	...	...	...	9	9	
	Beurre d'Anjou ...	...	6	...	...	...	6	
	Parrot	...	...	...	...	10	10	
	William's Bon Chretien.	...	13	...	...	...	13	
	Seedling Bergamot ...	...	...	...	...	6	6	
	Fondante Thirriot ...	...	10	...	...	10	20	
	Dr. Hogg	...	...	...	...	7	7	
	Triomphe de Vienne ...	...	6	...	...	...	6	
	Beacon	...	...		...	6	10	
	Beurre de Naghan ...	...	...	...	...	6	6	
	Charles Ernest ...	...	12	...	...	...	12	
	Roosevelt	...	...	...	...	6	6	
	Doyenne d'Ete ...	...	10	...	...	...	10	
	Blicking	...	...	...	...	6	6	
	Gansels Bergamot ...	...	6	...	...	...	6	
	Santa Claus ...	...	...	...	...	6	6	
	Josephine de Malines...	...	6	...	...	9	15	
	Precoce de Juillet ...	...	...	...	...	5	5	
	Dr. Jules Guyot ...	...	11	...	...	6	17	
	Madame Treyve ...	...	...	...	...	10	10	
	Durondeau ...	...	7	1	...	2	10	
	Hessle	...	5	...	1	13	19	
	Beurre d'Amanlis ...	...	12	...	...	10	22	
	Emile d'Heyst ...	...	5	...	...	10	15	
	Marie Benoist ...	...	6	...	...	...	6	
	Clapp's Favourite	...	5	...	...	10	15	
	Louise Bonne of Jersey	...	2	...	...	...	2	
	President Barabe ...	...	5	...	...	...	5	
	Thompson ...	...	5	...	...	...	5	
	Winter Nelis ...	...	4	...	...	...	4	
	Marguerite Marillat ...	...	6	...	...	...	6	
	Seckle	...	...	6	...	...	6	
	Beurre Fouqueray ...	...	...	6	...	...	6	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	West block.	South block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
Pear trees	Directeur Hardy ...	...	...	5	...	...	5	Bush and Pyramid.
	Colmar d'Eto ...	...	6	6	...	...	12	
	Princess	...	6	6	...	...	12	
	Belle Julie ...	...	6	6	...	...	12	
	Doyenne du Comice ...	...	2	4	...	...	6	
	Total ...	...	232	46	3	175	456	
	Beurre Hardy ...	...	14	...	...	5	19	Single Cordon.
	Clapp's Favourite ...	...	10	...	...	...	10	
	Durondeau ...	...	8	...	...	...	8	
	Madame Treyve ...	...	10	5	...	...	15	
	William's Bon Chretien	...	9	...	...	5	14	
	Marguerite Marillat...	...	12	...	...	5	17	
	Doyenne du Comice ...	...	10	...	...	5	15	
	Fondante Thirriot ...	...	...	5	...	...	5	
	Louise Bonne of Jersey	...	10	...	...	3	13	
	Conference ...	...	9	...	...	5	14	
	Emile d'Heyst ...	...	9	...	...	...	9	
	Winter Nelis ...	...	5	...	...	...	5	
	Fondante d'Automne ...	...	...	5	...	...	5	
	Beurre Superfin ...	...	...	...	...	5	5	
	Princess	...	...	5	...	5	1	
	Beurre Fouqueray ...	...	...	5	...	...	5	
	Beurre Diel ...	...	...	...	...	5	5	
	Directeur Hardy ...	...	...	5	...	...	5	
	Beurre d' Anjou ...	...	...	...	...	5	5	
	Colmar d'Eto ...	...	...	5	...	...	5	
	Total ...	...	106	35	...	48	169	
	Directeur Hardy ...	...	11	...	...	...	11	Horizontal trained.
	Duchess d'Angouleme	...	1	...	...	...	1	
	Clapp's Favourite ...	...	2	...	...	...	2	
	Josephine de Malines...	...		...	...	...	1	
	Emile d'Heyst ...	...	2	...	...	...	2	
	Louise Bonne of Jersey	...	1	...	...	...	1	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	West block.	South block.	East block.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
Pear trees	Beurre Superfin ...	...	1	...	...	...	1	Horizontal trained.
	Princess	...	6	...	...	...	6	
	Conference ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	2	...	...	...	2	
	Durondeau ...	...	1	...	...	...	1	
	Pitmaston Duchess ...	...	1	...	...	...	1	
	Fondante d'Automne...	...	1	...	...	...	1	
	Doyenne du Comice ...	...	2	...	...	...	2	
	Winter Nelis ...	4	...	...	...	...	4	
	Marguerite Marillat ...	...	5	...	...	...	5	
	Total ...	4	39	...	...	...	43	
	Kashmir	...	...	...	38	...	38	Standards.
	Marguerite Marillat ...	...	...	6	...	...	6	
	King Karl (Starks) ...	...	1	...	3	1	5	
	Anjou (,,) ...	...	3	...	4	...	7	
	Lincoln (,,) ...	...	3	...	5	...	8	
	Howell (,,) ...	...	6	...	3	...	9	
	Duchess (,,) ...	...	3	...	1	1	5	
	Bartlet (,,) ...	...	8	...	4	1	13	
	Seckle (,,) ...	...	4	...	...	1	5	
	Marie Louise ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	5	11	...	...	16	
	Conference ...	...	2	...	...	...	2	
	Emile d'Heyst ...	...	3	...	...	...	3	
	Madame Treyve ...	...	8	...	...	...	8	
	Count de Lamy ...	...	3	...	...	...	3	
	Louise Bonne of Jersey	...	2	...	...	...	2	
	Beurre Capiaumont ...	...	6	...	...	...	6	
	Princess	...	2	...	...	...	2	
	Doyenne du Comice ...	...	2	...	...	...	2	
	William's Bon Chretien	...	2	...	...	...	2	
	Souvenir du Congress...	...	2	...	...	...	2	
	Marie-Louise d'Uccle...	...	2	...	...	...	2	
	Fertility	...	28	5	3	...	36	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	West block.	South block.	East block.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
	Seekle	...	...	2	...	...	2	Standards.
	Bartlett Hybrid (Starks)	...	...	...	5	...	5	
	Roihl Best (,,)	...	...	...	4	2	6	
	Bonssock (,,)	...	...	...	3	2	5	
	Triumph (,,)	...	...	...	4	...	4	
	Winter Bartlett (,,)	...	...	...	...	4	4	
	Total ...	...	27	24	77	12	210	
Pear trees	Princess	...	5	...	...	...	5	Upright trained.
	Conference ...	...	...	...	...	3	3	
	Madame Treyve ...	...	...	5	...	...	5	
	Marie Louise d' Uccle	...	...	...	...	4	4	
	Louise Bonne of Jersey	...	...	...	...	4	4	
	Bourre Hardy ...	5	...	...	...	...	5	
	Fondante d' Automne	...	...	...	...	3	3	
	Winter Nelis ...	...	...	...	4	...	4	
	Conseillor de la Cour...	...	...	...	...	3	3	
	Doyenne du Comice ...	...	...	...	...	3	3	
	Marguerite Marillat...	4	2	...	...	...	6	
	Total ...	9	7	5	4	20	45	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Late Transparent ...	...	...	...	...	6	...	6	Bush.
	Guthrees Late Gage ...	...	4	...	...	...	...	4	
	Deniston's Superb Gage.	...	3	...	...	...	10	13	
	White Botan ...	...	1	...	...	...	...	1	
	Satsuma	...	2	...	...	1	...	3	
	Burbank	...	2	...	...	...	...	2	
	Prosperity... ...	...	5	...	...	...	...	5	
	Reine Claudede Bavay	...	3	...	...	...	...	3	
	Belle de Louvain ...	...	...	...	...	...	6	6	
	Curlew	...	5	...	...	...	...	5	
	Utility	...	2	...	...	...	...	2	
	Greengage... ...	...	1	...	...	5	...	6	
	Coxs Emperor ...	...	4	...	...	...	...	4	
	Heron	...	5	...	...	...	...	5	
	Mitchelsons ...	...	8	...	...	...	...	8	
	Monarch	...	...	3	...	...	...	3	
	Ickworth	...	3	...	...	...	...	3	
	Stark's Gold ...	3	...	...	...	...	...	3	
	Diamond	...	3	...	...	...	...	3	
	Belgian Purple ...	...	1	...	...	...	10	11	
	Bittern	...	5	...	...	...	...	5	
	Rutland Plumcot ...	1	...	...	...	...	...	1	
	Primate	...	5	...	...	...	...	5	
	Pond's Seedling ...	...	7	...	...	3	...	10	
	Admiral	...	5	...	...	...	...	5	
	Stark's Shiro ...	1	...	...	...	...	...	1	
	President... ...	...	6	...	...	...	...	6	
	Stark's Omaha ...	...	...	1	...	1	...	2	
	Jefferson	...	2	...	...	...	...	2	
	Autumn Beauty ...	...	...	1	...	...	...	1	
	Wyedale	...	3	...	...	...	...	3	
	King of the Damsons...	...	...	...	...	2	...	2	
	Kirks Blue ...	...	3	...	...	...	...	3	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1923. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Shepherd's Bullace ...	...	...	...	...	3	...	3	Bush.
	Czar ...	...	6	...	...	...	...	6	
	Langley's Bullace ...	...	...	...	...	3	...	3	
	Victoria	...	6	...	...	...	...	6	
	White Damson ...	...	...	...	...	3	...	3	
	Prince Englebert ...	...	3	...	...	..	...	3	
	Prune Shropshire ...	...	...	...	...	3	...	3	
	Kashmir Greengage ...	...	4	...	...	...	...	4	
	Merryweather Damson	...	...	...	...	10	...	10	
	Count d'Althan gage...	...	1	...	...	...	...	1	
	Stark's America ...	...	...	2	...	...	...	2	
	Stint	...	1	...	...	...	...	1	
	Burbanks Giant Prune	...	8	...	...	...	4	12	
	Yellow Pershore ...	...	...	...	...	1	..	1	
	Total ...	5	117	7	...	41	30	200	
	Decaise	...	...	...	...	1	...	1	Fan trained.
	Kirkes	...	...	...	...	2	...	2	
	Jefferson	...	...	...	...	2	...	2	
	Mallard	...	...	...	...	1	...	1	
	Golden Esperen ...	...	...	...	...	1	...	1	
	Oullin's Golden Gage...	...	...	...	...	2	...	2	
	Reine Claude d' Althan.	...	...	...	...	1	...	1	
	Early Transparent ...	...	...	...	...	1	...	1	
	Cox's Golden Drop ...	...	...	...	...	1	...	1	
	Transparent Gage ...	...	...	...	...	1	...	1	
	Greengage ...	...	...	...	...	2	...	2	
	Golden Transparent Gage.	...	...	...	...	1	...	1	
	Belgian Purple ...	...	...	...	...	1	...	1	
	Total ...	...	...	...	...	17	...	17	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Cherry trees ...	Morello	...	16	...	3	3	...	22	Trees.
	Kentish	...	12	...	...	...	16	28	
	Bigarreau Kentish ...	...	...	...	...	...	6	6	
	Gloire de France ...	...	1	...	...	...	5	6	
	White Heart ...	...	...	...	...	...	4	4	
	Black Heart ...	...	...	...	...	...	5	5	
	Kashmir	...	24	...	...	...	7	31	
	Montmorency King ...	...	2	...	...	1	...	3	
	Burbank	...	4	...	...	1	...	5	
	Total ...	...	59	...	3	5	43	110	
	Turkey Black Heart ...	...	...	...	...	1	...	1	Fan trained.
	Late Black Bigarreau...	...	...	...	...	1	...	1	
	Frogmore Bigarreau...	...	...	...	...	1	...	1	
	Noir de Guben ...	...	...	...	...	1	...	1	
	Belle de St. Trone ...	...	...	...	...	1	...	1	
	Early Rivers ...	...	...	...	...	1	...	1	
	Total ...	...	...	...	...	6	...	6	
Orange trees ...	Japanese Satsuma ...	...	1	...	...	1	...	2	Trees.
	Japanese Kumquot ...	...	8	...	...	4	...	12	
	Malta Blood ...	...	14	...	...	...	2	16	
	St. Michael's ...	...	13	...	...	1	...	14	
	Jaffa	...	2	...	...	1	...	3	
	Malta Oval ...	...	2	...	...	1	...	3	
	Silver	...	3	...	...	...	1	4	
	Excelsior	...	1	...	...	1	...	2	
	St. Michael's Tangierin.	...	1	...	...	...	5	6	
	St. Michael's Dom Louise.	...	1	...	...	2	...	3	
	St. Michael's Sustain...	...	1	...	...	...	1	2	
	Ditto Achilles	...	...	...	...	...	1	1	
	Total ...	...	42	...	...	11	10	68	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	Planted 1918. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Lime and Lemon trees.	Kazla Lime ...	...	1	2	...	...	...	3	
	Imperial Lemon ...	...	...	...	...	...	2	2	
	Gora Lime ...	...	2	1	...	...	...	3	
	Bijou Lemon ...	...	...	...	...	4	...	4	
	Nagzi Lime ...	...	6	...	...	...	...	6	
	Total ...	...	9	3	...	4	2	18	
Walnut trees ...	Dwarf Prolific. ...	...	7	...	...	...	10	17	
	Kashmir	...	6	2	...	...	...	8	
	Total ...	...	13	2	...	...	10	25	Trees.
Peach trees ...	Princess of Wales ...	...	...	...	3	...	...	3	
	Peregrine	...	...	...	...	3	11	14	
	Alexander	...	...	...	...	3	10	13	
	Duke of York ...	...	...	...	...	1	16	17	
	Exquisite	...	...	...	...	...	2	2	
	Late Devonian ...	...	...	...	...	2	...	2	
	Lady Palmerston ...	...	...	...	...	2	...	2	
	Kestrel	...	...	...	...	6	...	6	
	Hales Early ...	...	...	...	...	3	...	3	
	Total ...	...	...	...	3	20	39	62	
Apricot trees ...	Superb (Starks) ...	...	...	...	...	1	...	1	
	Blenheim	...	...	...	...	6	...	6	Trees.
	Kashmir	...	7	...	...	...	...	7	
	Total ...	...	7	...	...	7	...	14	

Species of fruit trees.	Variety.	Planted 1914-18.					Planted 1913.	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9	10
Fig trees ...	White Marseilles ...	...	...	...	...	...	1	1	
	Bourjassotte Grise ...	...	...	...	...	...	2	2	
	Monaco Bianco ...	...	...	...	...	...	1	1	
	Total ...	...	...	...	...	...	4	4	
Quince trees ...	Meeks Prolific ...	...	1	...	...	1	...	2	Trees.
	Champion... ..	...	1	...	...	...	...	1	
	Portugal	...	1	...	...	1	...	2	
	Total ...	...	3	...	...	2	...	5	
Almond trees ...	Hill Almond ...	...	12	...	...	...	...	12	
	Total ...	...	12	...	...	...	...	12	

Species of fruit t ees.	Variety.	Planted 1914-18. Upper garden. South block.	East block.	North block.	Lower garden.	Planted 1918. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
Wineberry	.....	...	...	...	6	...	6	Berries.
Lowberry	.....	...	...	...	...	6	6	
King's Acre Berry ...	.....	...	...	...	5	...	5	
Loganberry ...	.....	...	...	...	3	1	4	
Phenomenal ...	.....	...	...	...	3	1	4	
Laxtonberry ...	.....	...	...	...	3	...	3	
Blackberry... ...	Blowers	...	...	...	100	...	100	
Ditto	Pyne's Giant Himalaya Berry of California.	...	...	...	100	...	100	
	Total ...	...	...	...	220	8	228	
Strawberry ...	Givon's late Prolific...	...	...	...	900	...	900	Plants.
	Louis Gauthier ...	...	500	...	350	...	850	
	Royal Sovere'gn ...	3,000	3,000	...	1,250	...	7,250	
	Laxton's Cropper ...	...	...	...	400	...	400	
	Total ...	3,000	3,500	...	2,900	...	9,400	
Currant	Boskoop Giant Black...	...	2	...	...	...	2	Bushes.
	Defender Black ...	...	1	...	...	...	1	
	Southwell's Black ...	...	20	...	20	...	40	
	Total ...	...	23	...	24	...	47	
Nut trees ...	White Filbert ...	...	...	...	2	...	2	Trees.
	Red Filbert ...	...	...	...	3	...	3	
	Prize Cob	...	...	...	3	...	3	
	Kentish Cob ...	...	...	...	3	...	3	
	Total ...	...	...	...	11	...	11	

Species of fruit trees.	Variety.	Planted 1914-18. Upper garden. South block.	East block.	North block.	Lower garden.	Planted 1913. Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9
Grape Vines ...	Campbell's Early (Starks).	...	2	...	...	...	2	Vines.
	Hicks (Starks) ...	...	3	...	...	...	3	
	King (,,) ...	...	2	...	...	...	2	
	Eclipse (,,) ...	...	2	...	...	...	2	
	King Philip(,,) ...	...	2	...	...	...	2	
	Wilder (,,) ...	...	2	...	...	...	2	
	Worden (,,) ...	...	2	...	...	...	2	
	Niagara (,,) ...	...	2	...	...	...	2	
	Total ...	...	17	...	...	...	17	

Summary of Fruit Trees planted to 30th June 1918.

	1913.	1914-18.	Total.
1	2	3	4
Bush Apple trees	432	1,949	2,381
Standard „ „	55	676	731
Horizontal trained Apple trees ...	27	47	74
Upright „ „ „ ...	10	24	34
Palmette Verrier „ „ „ ...	...	23	23
Fan „ „ „ ...	...	5	5
Double Cordon „ „ „ ...	...	3	3
Single „ „ „ „ ...	...	3	3
Bush and Pyramid Pear „ ...	175	281	456
Single Cordon „ „ ...	48	141	189
Horizontal trained „ „ ...	...	43	43
Standard „ „ ...	12	198	210
Upright trained „ „ ...	20	25	45
Bush Plum trees	30	170	200
Fan trained Plum trees	...	17	17
Cherry standard trees	43	67	110
Cherry fan trained trees	...	6	6
Orange trees	10	58	68
Lemon „	2	16	18
Walnut „	10	15	25
Peach „	39	23	62
Apricot „	...	14	14
Fig „	4	...	4
Wineberry	...	6	6
Lowberry	6	...	6
Loganberry	1	3	4

	1913.	1914-18.	Total.
1	2	3	4
King's Acre Berry	...	5	5
Phenomenal „	1	3	4
Laxtonberry „	...	3	3
Giant Himalaya Blackberry	...	100	100
Blower's Blackberry	...	100	100
Strawberry plants	...	9,400	9,400
Currant Bushes	...	47	47
Almond trees	...	12	12
Nut „	...	11	11
Quince „	...	5	5
Grape Vines	...	17	17

C. H. HOLDER,

In charge, Fruit Experiment Station, Shillong.

The 24th August 1918.

Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st July 1917 to 30th June 1918.

Receipts.	Amount.	Expenditure.	Amount.
1	2	3	4
	Rs. a. p.		Rs. a. p.
Sale-proceeds of Apples ...	636 10 0	Allowance to Superintendent	3,000 0 0
,, of Pears ...	17 0 0	Establishment ...	2,297 2 8
,, of Peaches...	19 0 0	Petty construction ...	1,333 2 0
,, of Strawberries.	22 12 0	Seeds, Plants and Manures	1,414 7 0
,, of Strawberry plants.	126 6 0	Instruments, Appliances, Apparatus and Machinery.	134 1 0
,, of Timber ...	87 6 0	Wages of labourers ...	4,138 12 0
		Service postage ...	20 0 0
		Other charges ...	580 0 4
Total Receipts ...	909 2 0	Total Expenditure ...	12,917 9

ANNUAL REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 30TH JUNE 1918.

General.

This station was established in January 1914. It is situated on the Sylhet Road, $3\frac{1}{2}$ miles to the west of the subdivisional station of Karimganj, which lies on the Assam-Bengal Railway.

The total area of the farm is a little under 80 acres. Leaving out a compact block of 8 acres which has been set apart for the farmstead and quarters for the staff, and the area covered by roads and drains estimated at 4 acres, the net area available for cultivation is about 68 acres.

The station is devoted mainly to experimental work on rice and jute.

Character of land and soil.

2. The farm lies close to the Langai river which occasionally rises in high flood, and lays the country all round under water. This liability to floods is characteristic of the rice lands in the locality.

The soil of the greater portion of the farm is a deep alluvial clay of fine texture, though not particularly heavy. In the higher lands, it is somewhat lighter in character and may be described as a medium loam.

Equipment.

3. Some improvements were made in the apprentices' quarters and cattle sheds, and ideal wire fencing was purchased for enclosing the staff quarters, but beyond this no important changes were made in equipment during the year.

During the year 1915-1916 a long drain, leading from the outheast corner of the farm to a *khal* near by, was dug for the purpose of draining the residential area; in former years this area was liable to be converted into a swamp during the rainy season.

It was subsequently found that when the water rose in the Langai river during high flood, there was a back-flow up the abovementioned *khal* and along this drain. It was, therefore, decided to erect a small sluice gate with the object of preventing such back-flow of river water into the farm lands.

The work was carried out in the cold weather of 1916-1917 at a cost of slightly under Rs. 100 and has proved beneficial

Last cold season the earth obtained in clearing a drain which runs along the eastern boundary of the farm was thrown up in the form of a protecting bank. Although this bank is little more than eighteen inches above the level of the surrounding land, the effect in keeping out flood water has already been quite noticeable. It seems that this bank could be advantageously enlarged and extended on the northern as well as the eastern side, to secure the farm against any but the highest floods. If this could be achieved the expenditure of 200 or 300 Rupees which would be necessary would be thoroughly justified. Even in high flood such a bank would be of much value because if the flood water could be kept out even for a few days, the risk of injury to the farm crop would be much reduced.

The total number of working cattle remains at 30 as at the close of the previous year, and these cattle have remained in healthy condition throughout. Towards the end of the present year a new departure was inaugurated by the provision at the farm, of a stud bull for the use of the surrounding district. As the animal was brought from the Upper Shillong Farm only a few weeks before the end of the year, no opinion can yet be formed as to whether or not he will prove useful in the neighbourhood.

Character of the year.

4. The official agricultural year is found extremely inconvenient for the purpose of report. It covers the latter half of one *kharif* season and first half of the *kharif* season following, and includes, of course, the *rabi* season intervening.

The following table shows the rainfall during each of these periods :—

	Actual.	Normal.
1	2	3
Last half of *kharif* 1917.		
July 1917	24·95	23·11
August „	27·72	22·83
September „	13·81	18·58
October „	6·7	8·31
Total ...	73·18	72·83

—	Actual.	Normal.
1	2	3
Rabi 1917-18.		
November 1917	4·78	1·31
December 1917	...	0 56
January 1918	·08	0·75
February 1918	·44	1·46
Total ...	5·30	4·08
First half of *kharif* 1918.		
March 1918	14·46	8·80
April 1918	9·72	18·72
May 1918	18·69	21·19
June 1918	25·54	31·45
Total ...	68·41	80·16
Total for the year ...	146·89	157·07

The *kharif* season of 1917 was a satisfactory one and no floods occurred. There was some shortage of rainfall in September at the time of transplanting late paddy, which somewhat reduced the yield from that portion of the crop, but otherwise the season was very favourable and good crops were obtained. The *rabi* season was not a favourable one, as, except for a unseasonably heavy downpour on the last day of October, no rain of any consequence fell during the four cold-weather months. The combined effect of this heavy downfall at the very beginning and of the subsequent absence of rainfall, was that *rabi* crops were generally poor.

Rice breeding.

5. As befits a station situated in such an extensive rice-growing district as the Surma Valley, attention is devoted mainly to effecting improvements in this staple.

Rice-breeding experiments were arranged in 1914, after a consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Rai Bahadur B. C. Basu, Special Officer for Agriculture, and Mr. G. P. Hector, Economic Botanist, Bengal. These experiments have been carried on since.

It was hoped to obtain definite results after 3 or 4 years' work, but, owing to the unfortunate floods which have interfered with the continuity of the experiments, the work has been delayed, and a further period of a year or two will be required before definite results can be expected.

Ordinary rice seed is usually found on examination to be a mixture of different types of unequal quality and productive power. Some of these types are pure, and, therefore, breed true; others are the products of natural crossing and split into types differing in character, and are consequently unreliable. The types also differ in regard to their productive power and other characters.

The method of breeding followed in the farm starts by growing in the first season, from ordinary village seeds, as many local varieties of rice of each class as can be procured, and in picking out from each as many distinct types as can be detected while the crop is still standing in the field, each type being represented by the ripe ears taken from a single plant.

The next step is to grow the various lots of seed thus obtained in small plots side by side, first with the object of testing which of these types are constant and therefore pure, and which again split as the result of previous crossing, and secondly, with the object of comparing the pure types in regard to yielding power and other characters. Though the rice flower is normally self-fertilized, a certain amount of natural crossing is known to occur. A clear space of 3 to 6 feet around each plot is kept in order to minimise the risk of inter-crossing between adjacent types.

The next and third step is to take the pure types and grow them a second or even a third time (which is to be the work of the third or fourth season) in order to confirm the results of the second season as to their respective merits.

In this way at the end of the third or the fourth season, we should be able to fix upon one or more of these pure lines, as being more prolific and of better quality all round, than the rest within their own class. The next and last step will be to propagate these selected pure lines on a field scale, for the purpose of distributing the produce as seed.

The experiment was commenced in 1913-1914 with four classes of rice, namely, (1) early *Aus* rice, which is usually grown broadcast and of which two crops may be taken in the course of a year. (2) transplanted *Aus*, (3) *Sail* or winter-rice, (4) *Asra*, which comprises the comparatively short stemmed varieties of *Amon* or swap winter rice, and which is capable of being grown either broadcast or transplanted.

The floods of 1915 destroyed all work done up to that time with transplanted *Aus*, *Sail* and *Asra*, and the selection work with regard to these classes had to be undertaken *de novo*. It was then decided to restrict the work for some years to come to (1) early *Aus* which was spared by the 1915 floods and (2) *Sail* transplanted winter rice, which forms the most important class of rice grown in the country.

Below is noted the work done on these two classes of rice since the experiment started.

Early Aus.—This class comprises three sub-classes of rice *viz.*, *Murali, Chengri and Dumai.* These differ from each other in regard to the depth of water which they can stand during the later stages of growth and the time they take from sowing to harvest. A total of 161 distinct types was obtained by the selection work done in 1914. Out of these, 61 were obtained early enough to permit of their being sown again in September of that year.

The resulting plants were examined as to purity, and 3 types were rejected as unsuitable for further work. Early in 1915 these types were sown again, but were destroyed by the July flood of that year. Fortunately, however, duplicate halves of the seed of 57 of these types had been kept in reserve, as a precaution against the accidental loss of the stock, and, with these seeds the work was continued in that year. These 57 types of early *Aus* were sown in September, and reaped in December, 1915, and as was to be expected, the yields varied within very wide limits. From the seed thus obtained three further series of plots were sown in May 1916, that year's crop being the third generation from the first selected types. Full records are kept of the dates of sowing, flowering, and havesting of each type, and of its yield of grain and straw. These particulars, together with a description of the characters of each type, are kept in a register of pure cultures on the farm. As was expected, the variations in yield among the plots of the third generation were considerable, and not sufficiently in agreement with the yields obtained in the first two generations, to enable a selection to be made.

A further set of one series was laid down in September, 1916, with seeds from the early crop of that year. These plots were injured by the October floods to such an extent that comparative results could not be obtained, although sufficient seeds of that, the fourth generation, were harvested, to enable the work to be continued in the following year. One of these types was obviously different from the others, and was in consequence discarded.

The work was continued in the year under report, the selected varieties being again tested and compared in their fourth generation. A few varieties which did well in 1916 also gave a heavy outturn in the past year, but as yet no variety has been found sufficiently outstanding, to justify any recommendations being made. From the fifth generation of 1917 single seedling plants were again selected and the grain from these has been planted for the production, in the coming year, of the sixth generation. Plots of equal size and condition have been selected, and equal number of seedlings transplanted in all the plots, in this way the purity of the strain is maintained, and the respective merits of all the types can be carefully compared.

Sail.—This is the most important class of rice in Assam. As the result of the work done in 1915, 580 types were separated, and these had just been sown in seed beds, when the great flood of July came and destroyed them all. For the purpose of making the primary selection of types for a fresh start, seeds of 148 varieties of this class of rice were then collected, mostly from different parts of the Sylhet district, a few being obtained from the Sibsagar district, and some being the produce of the farm itself. On the receipt of these varieties of *sail*, each was described in detail, and all particulars entered in the "register of type selection of *sail* rice" kept in the farm.

The seeds of these 148 varieties were sown in June, and transplanted towards the end of July, 1916. Although the plots were injured by the October floods, sufficient plants remained to enable representative types to be selected from each plot for the following year's work.

Five additional types have been included in 1916 bringing the total up to 153, all of which were grown as pure line cultures in 1917.

Among the 153 types with which we began this work, a number were specially fine rices, which are only grown by cultivation on a very small scale for luxurious tastes or special purposes. As such varieties usually give a very light crop, a few of the very poorest yielding varieties have been discarded. Again, a number of varieties were found to have an objectionable amount of awns or to be otherwise undesirable, and of such kinds a further rejection has been made. Altogether 48 of what seemed decidedly poorer varieties have been rejected, and the work is being continued in the present year with the remaining 105 types. A few other types have since been obtained; so that altogether we have for comparison 109 types in the coming year.

Paddy seeds which may have fallen from the previous year's crop and become mixed in the soil, retain the germinating capacity for a very long time. In order to free the experimental area from any such seeds, it has been found necessary to prepare the land a number of times, and to allow two weeks or so to elapse between one preparation and the next, so as to permit stray seeds to germinate. In this way the land carrying these experimental plots was prepared six times, before it was considered safe to plant the pure types. Even when all precautions are taken, plants of a different type from the original selection are occasionally found at harvest time. Some of these may have been washed in by flood water or carried by implements, or they may be the product of cross fertilization which occurs rarely in the rice plants.

Intra-varietal selection experiment.

There appears to be a difference of opinion among Botanists, as to the extent to which it may be possible to improve the productivity of a variety, by selecting heavy yielding single plants from that variety.

In order that some information might be gained on this point, the above experiment was begun in the past year. *Lati sail* as one of the heaviest yielding local varieties was selected for the trial, seedlings were transplanted in $\frac{1}{10}$th of an acre on the 10th July 1917. At harvest time 100 plants having the same characters as the original variety were selected at random, and kept separately. All the well-formed grains of the ears of each single plant were afterwards counted, and the number of grains was found to vary from 232 to 1,140. The seeds of five of the heaviest yielding plants will be tested against five of the least productive, each being grown separately and as a pure line type.

Minor experiment.

6. The experiments carried out on a small scale included the following :—

(1) *Bonemeal as manure for double crop rice land* versus *no manure*.—This experiment which was begun in 1915 was designed to give some information, firstly, as to whether or not bonemeal-manuring will prove profitable on the Karimganj Farm or similar rice lands, and secondly, as to the quantity of bonemeal which should be applied.

Bonemeal has been used at three different rates, *viz.* :—

(*a*) At 247 pounds per acre applied in alternate years with no manure in the intervening years.

(*b*) At 494 pounds per acre applied in alternate years and no manure in the intervening years.

(*c*) At 247 pounds per acre applied yearly.

The first crop of 1915 and the second crop of 1916 were injured by floods and no results were available. The yields, as far as they have been obtained for three years, are shown in tabular form :—

	Yield per acre in pounds.			
	1915 2nd crop.	1916 1st crop.	1917 Two crops.	Average Annual crop.
1	2	3	4	5
Bonemeal 247 pounds per acre in alternate years	3,336	1,537	4,484	3,119
No manure	2,788	1,435	4,164	2,795
Bonemeal 494 pounds per acre in alternate years	2,962	1,570	4,277	2,936
No manure	3,013	1,536	4,066	2,871
Bonemeal 247 pounds per acre yearly ...	2,902	1,605	3,812	2,773
No manure	3,065	1,475	3,353	2,631

The disturbing effect of the floods in the first two years makes this experiment of little value. The average yields, however, indicate that a light application will be more profitable than a heavy one.

The question as to whether or not any application of bonemeal is likely to yield a profit on soil, such as that of Karimganj Farm, can only be decided by a continuation of the experiment and accordingly similar work is again being carried out.

(2) *Green manuring for rice crop* versus *no manure*.—This experiment, started in 1915 with cowpea and *Dhaincha*, was continued in 1916 with slight modifications. Duplicate plots were treated with ground limestone at 823 pounds per acre in that year. The same series of plots was again green cropped in 1917, and the average yields for the three years were as follows :—

	Pounds per acre.
No manure	1,817
Dhaincha alone	2,125
Cowpea alone	1,804
No manure	1,844
Dhaincha and 823 pounds ground limestone in 1916 ...	2,192
Cowpea and 823 pounds ground limestone in 1916 ...	2,157

Cowpea does not grow well on the farm, and even on the limestone area the crops are poor. *Dhaincha* has always grown successfully, and is specially good on the plots manured with ground limestone.

The *sail* paddy crop was slightly damaged in parts by the October floods of 1916, and, therefore, the above figures are not absolutely comparative. There would, however, seem to be no doubt of the benefit to the succeeding rice crop of a well-grown leguminus crop, as shown by the crop produced on the *Dhaincha* plots. A somewhat similar increase has been obtained from those plots which received ground limestone as an additional dressing in 1916. It would, however, be difficult to estimate how much of the increased yield was due to the green crop, and how much to the limestone. It is only right to say that the cowpea crop has always been a very small one, even on the limestone plots.

(3) *A combined variety and manurial experiment on jute.*—Three varieties were tested against one another, *viz.*, Kakaya Bombai, a pure line selected by Mr. R. S. Finlow, Fibre Expert, Bengal, a local variety, and a variety obtained from the Goalpara district.

The average outturn of fibre in pounds per acre for the three past years was as follows :—

	Kakaya Bombai.	Local Variety.	Goalpara Variety.
1	2	3	4
Yield per acre in 1915	2,036	1,224	1,738
Ditto in 1916	1,734	1,115	1,042
Ditto in 1917	1,441	1,301	915
Average for three years	1,704	1,213	1,231

The yields obtained from Mr. Finlow's variety leave no doubt of the great superiority of this selection over any of the ordinary varieties.

The manurial experiment on this crop was upset by a hail-storm, which occurred in the middle of April and which seriously injured the young jute plants, then 12″ to 18″ high.

Although late in the season six plots were resown, three had been manured with cowdung at 5½ tons per acre and three with cowdung at the same rate *plus* 820 pounds ground limestone per acre.

The average yield of fibre given by the cowdung plots was 1,015 pounds per acre, while the cowdung and limestone gave 1,359 pounds, that is an increase of 30 per cent.

Owing to the injury by hail most of the jute crop was of little value for fibre, and as there is a rapidly increasing demand for seed of the Kakaya Bombai variety, the largest number of the plots under this variety was kept for seed. The yield of seed was at the rate of 346 pounds per acre.

(4) *Jowar as fodder in the rains.*—*Jowar* was grown as a rains crop on an area of ·75 acre. Part of the crop was fed green, and part was chopped up for silage. The latter was not a great success as the plants had become too ripe before the preparation of silage was commenced.

The yield of green fodder was almost five tons per acre.

(5) *Dacca selected rices against country rices.*—As in previous years Mr. Hector's selected rices, *Indra Sail*, *Lambachikan* and *Kandulia*, were tested against a few of the most productive local rices.

The experiment was carried out in two separate series. In the first series 8 varieties were grown in plots of $\frac{1}{50}$th acre each, and the same number of seedlings was transplanted in each plot. In the second series it was arranged that six varieties should be tested in duplicate plots of $\frac{1}{10}$th acre. *George Sail*, however, was grown in one plot only as there were insufficient seedlings to transplant a second.

The following table shows the average results of these tests in pounds per acre :—

	First series.	Second series.	Average.
1	2	3	4
Lati Sail	2,530	2,200	2,365
Torabali	3,080	2,636	2,858
Indra Sail	2,832	3,180	3,006
Kandulia	2,970	2,440	2,705
Lambachikan	3,630	2,640	3,135
Balam	3,794	...	...
Hati Sail	3,300	...	...
George Sail	4,042	2,640	3,341

From the average yields here given, it would seem that George *Sail* is a heavier cropping variety than the Bengal rices, but this can only be decided by further trials, and in the coming year it is proposed to grow all the 8 varieties in duplicate plots of $\frac{1}{10}$th acre each.

(6) *Specific gravity selection of paddy seed.*—An experiment to test the method of selecting rice seed by specific gravity was carried out. The paddy seeds were immersed in saturated brine, and only those grains which were found to sink were used for seed.

Selected and ordinary unselected seeds were then grown under similar condition in seed bed, and the seedlings transplanted into similar duplicate plots. The seedlings were transplanted singly at a distance of 9″ apart.

The average yields obtained were 1,962 pounds per acre from selected seed, and 1,784 pounds from the unselected seed.

(7) *Ground limestone as manure for paddy land.*—This experiment was arranged in two series. In the first, ground limestone was applied at 820 pounds per acre in the cold weather of 1916, and transplanted *aus* paddy was grown on this area. In the second series the ground limestone was applied to duplicate plots at the above rate, immediately before transplanting in August.

The average yield from the lime plots was 2,161 pounds per acre, against 1,906 pounds from the unmanured plot. This increase of 255 pounds or over 3 maunds per acre is quite a useful one. We are arranging to repeat the experiment on the same area in the present year, to find whether the effect continues for more than one year, and whether the application of limestone is likely to be profitable.

(8) *Improved varieties of sugarcane from the Jorhat Farm.*—The three varieties B 147, B 376 and striped Mauritius were grown on a small scale.

The farm lands are situated at too low a level for the successful growth of sugarcane on a large scale, but a small area is grown with the object of giving the farm apprentices a knowledge of the cultivation of sugarcane, and of the making of *gur*.

Non-experimental crops.

7. A large area of non-experimental rice was grown during the year. Together with the experimental rice, it covered almost the entire area of the cultivated portion of the farm, the balance being occupied by small areas of sugarcane, and of jute an *dhaincha* which were grown for seed.

The total yield from the rice crop including the experimental *sail* rice was as follows:—

	Approximate area.	Total yield.	Yield per acre.
1	2	3	4
	Acres.	Tons.	Pounds.
Rice (*asra*)	27·1	27·63	2,362
Rice (*sail*)	26·2	23·3	1,992
Total in 1917	53·3	50·93	2,140
Total in 1916	53·90	25·26	1,051
Total in 1915	52·64	47·98	1,991

Dhaincha was kept for seed on an area of ·4 acres, and gave an outturn of 206 pounds, or at the rate of 572 pounds per acre.

Cultivation of cold weather crops.

8. A variety of cold weather crops was tried in the past *rabi* season. The land was well prepared in October, but the heavy rainfall which occurred at the end of that month spoiled all arrangements. The land was afterwards prepared a second time, but the work could not be so thoroughly done, and, therefore, the *rabi* crop did not get a favourable start.

Potatoes gave a small crop of 2·12 tons per acre, *cheena* gave about 200 pounds per acre and the yield from the other crops pulses, oil-seeds and cereals was negligible.

Insect pests.

9. No very serious damage was caused to the farm crops, although different insect pests made their appearance at various times.

The Farm Manager continues to take timely steps to combat any pests of the kind. Hand-picking, catching by light traps and by bag net, were variously resorted to, and the result was that no damage of any consequence was suffered by the farm crops during the year.

In the early stages of the development of the hairy caterpillar, the grubs are found clustered together on the leaves of the affected plants. At this stage much damage can be avoided by picking off all leaves bearing clusters of caterpillars, and killing the caterpillars in hot water or a little kerosine oil. This method has been very successfully carried out with the jute crop on the farm during the last few years.

The rice bug (Leptocorisa varicornis) is the cause of immense damage to the rice crop each year, and particularly to the early varieties. The most effective method of checking the ravages of this insect, is to prepare a light cloth about 15 feet long and 4 feet wide. Two boys used this by standing at opposite ends of the cloth, and with a corner in each hand they allow the middle to fall, and bring up the sides until they are about 18 inches apart. One side of the bag net so formed, is allowed to sweep along the top of the affected crop, while the workers run quickly across and across the plot. At each end the bag net is closed and twisted to destroy the many bugs which are captured in this way.

The stem borer moth is attracted by any light during the night time, and can be easily destroyed on this account. If an ordinary hurricane lamp is suspended over a barrel or tub of water, which has been covered with light film of kerosine oil, the moths will flutter in large number round the lamp and most of them will ultimately fall into the water and be killed by the kerosine. Where no large vessel is available, a small raised pond could be made with mud banks, filled with water and covered with a spoonful of kerosine, and a torch placed over it would provide sufficient attraction.

Receipts and expenditure.

10. The receipts during the year amounted to Rs. 2,854-10-10 but a sum of Rs. 1,320-9-4 was derived from the sale of seed paddy from the previous year's crop. As the whole crop of paddy has not been sold within the agricultural year only a close estimate of the total receipts can be given. Paddy was sold within the year worth Rs. 1,534-1-6. Paddy to the value of Rs. 66 was used for seed distribution throughout the district, and at the end of the year there remained in stock, paddy, *Kalai*, etc., of an estimated value of Rs. 145, making a total of Rs. 1,745-1-6.

This makes a total annual income for the year of approximately Rs. 1,800 against an income of Rs. 2,337 in the previous year. The great fall in receipts here shown is due to the fact that the crop of paddy had to be sold at about Re. 1-4-0 per maund, as against double that price in the previous year.

The total expenditure was Rs. 7,453-8-10 which compares with Rs. 7,294-2-11 in the previous year. It was distributed as follows :—

	1917-1918. Rs.	a.	p.
Establishment	2,699	1	4
Petty construction, including fencing, roads, bridges, etc.	525	14	0
Purchase of machinery	105	11	0
Feed of cattle	455	10	2
Seeds, plants and manures	143	3	10
Wages of labourers	2,246	14	9
Petty repairs	737	6	3
Books, maps and periodicals	36	8	0
Service postage stamps and telegrams	60	0	0
Unspecified charges	443	3	6
Total	7,453	8	10

11. The sanctioned establishment of the farm consists of :—

Staff—

	Rs.	
1 Farm Manager	100—5—200	
1 Assistant Farm Manager ...	25—1-8—40	*Plus* Rs. 10 Local allowance.
1 Farm clerk	25—1-8—40	
1 Peon	8 0 0	

In addition, arrangements are made for the entertainment of six apprentices to be trained for eventual employment, as Agricultural Demonstrators. The term of the training extends to 2 years.

The first apprentice trained at the farm was appointed as Demonstrator in August 1915. During the year 1916-17, three young men completed their training and were appointed as Demonstrators. The vacant apprenticeships were immediately filled up, and during the past year two more have finished their training. One has been appointed as Demonstrator and the other has suffered from ill-health since and cannot take up work. During the first half of the year under report six apprentices were entertained. In the latter half of the year one apprenticeship was kept vacant with the object of getting a suitable Muhammadan candidate, a suitable man has since been selected and

is to be appointed from the beginning of the present year. The scheme of giving a preliminary training to young men of the *Bhadralog* class intended for scholarships at Sabour was continued during the year. These young men, who are given an opportunity of qualifying for posts as Agricultural Inspectors, are trained in practical agriculture for one year. Two were selected in the beginning of the year under report. They worked satisfactorily and have since been awarded scholarships at Sabour. It has been decided not to fill the vacant apprenticeships as young men of a sufficiently high standard of education were not forthcoming.

Babu Surendra Nath Gupta, who was confirmed in the appointment of Farm Manager in August 1916, remained in charge throughout the year.

Srijut Nabin Chandra Barua resigned his post of Assistant Farm Manager at the beginning of the year, and was succeeded by Babu Girindra Kumar De who was promoted from the post of Agricultural Demonstrator, Cachar, to that of Assistant Farm Manager. Babu Nirod Bihari Sarma resigned his post of Farm Clerk towards the end of the year. He has been replaced by the appointment of Babu Jatindra Chandra Dutta to the vacant post.

J. W. McKAY,

Deputy Director of Agriculture,
Surma Valley and Hill Districts.

SHILLONG,
The 8th July 1918.

ANNUAL REPORT OF THE KAMRUP SUGARCANE EXPERIMENT STATION FOR THE YEAR ENDING THE 30TH JUNE 1918.

1. *Introductory.*—The objects and scope of this experiment were set out in paragraph 1 of the report for 1914.* For reasons explained therein it was proposed to take up 1,000 acres more or less, reclaim it and grow cane on it. Unforeseen circumstances have delayed the full accomplishment of this scheme up to date. The area reclaimed and under cultivation at the present time is some 18 blocks, comprising 817 acres in all, of which some 503 acres are now under cane plant and ratoon.

The area under cultivation on 30th June 1917 was 650 acres, the remaining 167 acres having been reclaimed during the year under report. Last year's report dealt up to 30th June 1917, with the ratoon and plant cane crops planted respectively in February to March 1916 and in February to March 1917. The present report is concerned with the subsequent development of those crops, which were harvested in March 1918, and also with the operations of this the fourth year of the experiment proper, including the preparation of the land, planting the new crop and its subsequent cultivation and behaviour to the end of June 1918.

2. *Land and communications.*—The site of the experiment is situated in North Kamrup under the Bhutan Hills about 17 miles by road north of Nalbari station, Eastern Bengal Railway, and lies between the new and old Pagladiya rivers and near the village of Topolia. The farm is approached from Nalbari station by a public road northward to Garbhitar village, some 10 miles, where a village track leading to Khagrabarigaon has been widened out and made into a carting road and extended to the present farm site which is 7 miles from Garbhitar. The greater portion of this tract consists of high land carrying tall grass jungle, with occasional swamps which are, however, capable of drainage, the fall from the hills to the south being from 15 to 20 feet per mile.

3. *Rainfall.*—Farm records have been kept since January 1915; the following table shows the figures for the Agricultural

* Annual report of the Kamrup Experiment Station, year ending June 30th 19 4.

year ending June 30th, 1918, with monthly averages of previous years :—

—	Inches.	Average of previous years since January 1915.
1	2	3
July (1917)	18·57	23·46 (2 years' average).
August „	12·87	18·76 „
September „	9·96	7·59 „
October „	8·61	6·68 „
November „	Nil	0·10 „
December „	Nil	0·13 „
January (1918)	Nil	0·25 (3 years' average).
February „	0·25	2·47 „
March „	3·56	3·57 „
April „	4·80	6·26 „
May „	9·25	17·69 „
June „	25·23	16·89 „
Total ...	93·10	105·85

The rainfall during 1917, January to December, totalled 80·5 inches and apart from some shortage in the early months of the year was well distributed, ceasing for all practical purposes about the middle of October.

From January to May 1918, which covers the important periods of planting, germination and early growth, the rainfall was some 12 inches below the average for the previous three years. Though germination and early growth more particularly of the earliest planted cane, was somewhat retarded in consequence, the young crop has since made very good progress and promises well.

4. *Soil.*—The soil of the high land varies from good loam to sandy loam on a sandy sub-soil. In a few places, the sand comes to the surface, but usually there is from 1 to 3 feet of good soil, while in the swamps the soil is stiff, on a stiff sub-soil, although it is probable that sand exists at no great depth. Except on the few sandy patches the soil is dark brown or black in colour, denoting good supplies of organic matter. On the whole, the soil is a good loam, easily worked once reclaimed, and very suitable for cultivation. Moreover, the soil is well adapted to the climate; the annual rainfall being high and well distributed demands a light free draining soil such as exists here.

Judging by the growth of the other crops, as well as sugarcane, the present fertility is high, and except on some of the lower lying parts, which before reclamation and drainage by us have probably been more or less swampy for generations, there is no evidence of any toxic factor; moreover, on these lower lying areas the toxic factor apparently rapidly disappears under cultivation after drainage and heavy rain. The evidence of fertility as shown by the growth of many and diverse crops confirms some soil analyses made personally some 4 years ago on samples from an adjoining tract.

5. *Buildings, fencing, etc.*—The buildings consist of the Manager's bungalow, staff quarters, office with dispensary, coolie lines, cattle shed, godown, smithy, etc. For the extension areas one mile of wire fencing was purchased at a cost of Rs. 1,555-8-0, making a total of 4½ miles of wire fencing enclosing the whole farm.

As in previous years and in spite of the fencing, bears caused a good deal of damage, though pig, deer, etc., were excluded.

6. *Cattle.*—There are 83 head of cattle on the farm at present, of which 18 belong to Government and 65 to Mr. Maxwell. These were very hard worked during the year, carting out machinery and plant for the factory, etc., etc.

At present the cattle are in good condition.

7. *Water-supply.*—Norton tube wells are used with great success, and an excellent supply of drinking water is available all the year round. These wells, distributed over the cane area, provide water also for the engines. In addition, a permanent running stream close by the coolie lines supplies water for washing purposes, etc.

8. *Labour.*—As in previous years labour was recruited personally by the Manager with the sanction of the Bihar and Orissa Government from Ranchi, the only difference this year being that recruiting was done on a 12 months basis instead of for 6 months.

This system works excellently, and a certain number of coolies have settled down here. Generally speaking, this imported labour force keeps very good health. At the moment the general health is satisfactory.

9. *Cultivating tackle.*—This comprises :—

2 steam tractors, Fowler's compound engines ;

1 five-furrow double ended plough ;

1 harrow ;

1 cultivator ;

1 roller ;

1 ridger ;

1 leveller ;

1 ditcher ;

1 motor plough, Fowler-Wyllie.

Most of the above has now been in use for 4 seasons and is in sound condition.

Spare parts for the engines to the amount of Rs. 3,609 were purchased during the year.

10. *Drainage scheme.*—The system of drainage adopted in 1916, outlined in paragraph 11 of the report for 1916, having proved so efficient, has been extended to the new area reclaimed, and is working quite satisfactorily. The water table has been considerably lowered in consequence, and the heaviest falls of rain are rapidly carried away, surface accumulations after such falls being now a thing of the past. The reclamation and drainage of new extension areas year by year undoubtedly improve the drainage of those areas previously reclaimed and put under cultivation, by dealing with water which heretofore used to flow in from surrounding unreclaimed land.

11. *Cane harvested—February to March.*—This comprises 250 acres of ratoons of the plant cane crop which was planted up in 1916 and harvested as plant cane in 1917, in addition to 260 acres of plant cane which was planted up in 1917. Reference may be made to paragraphs 11, 12 and 13 of last year's report. The early growth of these crops up to the end of June 1917 was therein described. It remains to outline its subsequent progress. The amount and distribution of the rainfall was favourable for the remainder of the growing season, the rains ceasing about the middle of October. Both plant and ratoon crops made good

progress up to this time, but neither quite came up to the crops of the previous year at the time the rains ceased, with the exception of one block of 60 acres of plant cane which was reclaimed 12 months previous to planting and green-manured in the meantime. This block was far and away above the average, a very excellent crop indeed, and shows what can be done given a fair chance. When harvested this block averaged about 30 tons per acre, some parts of it rising to as high as 34 tons.

The relative backwardness of the crops at this time may be accounted for, in the case of the ratoons, by the fact that the previous plant cane crop was very late harvested by reason of delay in completion of the factory, and in the case of the plant cane by the shortness of rain in the three months following planting out. Considering, however, that over most of the area under cane planting so closely followed reclamation from howling jungle, there being an interval of only 2 to 3 months in between, it is surprising that the crops make the growth they do.

As compared with the previous year ripening was slightly retarded, but as the figures given later show, the ratoons were fully ready to commence work on early in December, and, had the factory been ready, work on the ratoons could probably have been advantageously commenced during November. The plant cane ripened off a little later. In both plant cane and ratoons, Striped Mauritius and B. 376 ripened off first followed by B. 147.

Harvesting was commenced very late, *i.e.*, at the end of February 1918, and continued intermittently throughout March, the cane, as last year, being supplied to Mr. Maxwell, being sold to him on a sliding scale based on its sucrose content and the price obtained for the sugar manufactured. The *gur* factory of the previous year had in the meantime been under conversion by Mr. Maxwell into a factory for the manufacture of white sugar direct from the cane. This however was not completed in time to deal adequately with the crop. In the result only some 390 tons of cane were dealt with in the factory, as compared with 775 tons last year, the bulk of the remainder of the crop being thrown away, some being used for planting and distribution. This is a very deplorable state of affairs indeed, more particularly as it is the second year in which the greater part of the crop by far has been utterly wasted. It is hoped that the crop now on the ground will not be similarly lost during the coming milling season.

Not only have our crops been thus practically wasted for two successive years, but in both years the great delay in com-

mencing milling has kept the crops standing on the ground so late in the season as not only to prejudice the succeeding ratoons but to seriously inconvenience the normal working of the farm.

Outturn of cane.—We have again to record and regret the fact that owing to a combination of adverse circumstances similar to those which obtained during the previous milling season (*vide* page 5, report for 1917), and the chief of which were not under our own control, it is quite impossible to say exactly what the total crop was, as it proved out the question to weigh it all. The cane entering the factory was weighed but as this was almost entirely derived from one block of cane, the figures are only of value in relation to that block.

However, an effort to estimate the crop was made by weighing a measured average acre in one or two different places in the middle of each block under cane. The actual weighments recorded appear in Table I.

TABLE I.

Block No.	Area weighed.	Weight cane stripped for milling.	Variety.	Plant cane or ratoons.	Remarks.
1	2	3	4	5	6
		Tons.			
3	1 acre ...	11·06	B. 376 ...	Ratoons ...	The great delay, due to the incompletion of the factory, in commencing the harvesting of the previous year's plant cane undoubtedly had an adverse effect on the weight of this year's ratoon crop, which should have averaged at least 15 tons per acre.
	1 acre ...	10·8	S. M. ...		
4	1 acre ...	12·1	B. 147 ...		
	1 acre ...	13·0			
5	1 acre ...	11·7	Mixed varieties	30 acres each of ratoons and plant cane.	The plant cane on Blocks 7, 8, 9 and 10 suffered much as a result of a great shortness of rain in the three months following planting out, which undoubtedly reduced the crop for reasons explained in paragraph 18 of last year's report.
6	1 acre ...	34·0	B. 147 ...	Plant cane ...	Block No. 6 which averaged about 30 tons of cane per acre all over was, unlike the remaining blocks, reclaimed 12 months previous to planting up and was moreover green-manured and kept in cultivation in the meantime. It shows, I think, what may be expected under conditions such as may be expected to obtain all over in future.
	1 acre ...	25·0	Mixed varieties.		
7	1 acre ...	14·2	S. M. ...		
8	1 acre ...	14·1	S. M. ...		
9	1 acre ...	15·2	B. 147 ...		
10	1 acre ...	12·3	B. 376 ...		

Taking the figures for each block to be fairly representative of the whole block, by computation we arrive at an average yield for the whole area under cane of almost exactly 15 tons per acre.

Much bigger crops than this may confidently be expected in future years in my opinion; the ratoon crop should have been bigger had it been possible to harvest the previous plant cane crop earlier, and the plant cane crop was short as a result of the drought which followed planting in 1917 as explained in paragraph 13 of the report for 1917.

Quality of cane.—Analysis of the canes was commenced early in December 1917 and continued intermittently until the factory closed down at the end of March 1918.

Preliminary Analysis.—Previous to the actual factory operations in March, analyses were made on average samples of cane taken direct from the field.

The results appear in Table II. The figures show the sucrose content of the juice and also of the cane for both plant canes and ratoons of the three varieties of cane grown and serve to illustrate the progress of ripening. Thus the ratoons from Blocks I to IV were first analysed during the early part of December and again at the end of December, and all the figures show that ripening had proceeded well during the intervening period.

Similarly the plant canes from Blocks VI to X were analysed first during the last half of December, and again after 16 or 17 days, and the figures again show that the canes had ripened off considerably during that time.

The ratoons ripened off first as usual, and the figures for sucrose percentage and purity of juice show that they were certainly ready to commence milling early in December at any rate, though of course not then fully ripe.

The plant canes at that time were not so ripe, but were all showing a purity of over 80 per cent. which was increased to nearly 90 per cent. by the second week in January 1918. Had ratoon harvest commenced in December, by the time that it was finished the plant cane crop would have been fully ready to follow on.

As between the three varieties, in both plant cane and ratoons it will be seen that B. 376 and Striped Mauritius ripened off earlier than B. 147, which is rather a late cane.

Factory Analysis.—During the 15 days or so when the factory was actually working during March 1918, to meet the desire of the Factory Manager that the normal working of the factory should be interfered with as little as possible, a scheme of analysis

was carried out from which it was hoped to obtain a fair average figure for the sucrose content of the cane milled. This included daily estimations of the fibre content of the cane brought to the factory the previous day, analysis of the various mill juices, mill bagasse, etc.

The results show that, on the average, for every 100 parts of cane milled there resulted only 64·31 parts of juice containing 17·04 per cent. sucrose, and 35·69 parts bagasse with a sucrose content of 7·86 per cent.

TABLE II.

Block No.	Date.	Variety.	Juice expressed.	Sucrose in juice. Per cent.	Purity of juice. Per cent.	Sucrose in bagasse. Per cent.	Sucrose on cane. Per cent.	Remarks.
1	2	3	4	5	6	7	8	9
I	10th December 1917	Mixed ratoons ...	70 per cent.	15·59	90·8	7·10 per cent.	13·04 ...	Ratoons. (First half December 1917). Progress of ripening is shown by comparison of these figures with those for the same blocks made some 17 days later and given below.
II	12th December 1917	Ditto ...	74 per cent.	15·21	86·4	8·10 ...	13·36 ...	
III	15th December 1917	Striped Mauritius and B. 376 ratoons.	74 per cent.	15·64	88·9	7·03 ...	13·40 ...	
IV	18th December 1917	B. 147 ratoons ...	73 per cent.	14·50	83·6	6·07 ...	12·22 ...	
V	9th December 1917	Mixed plant cane and ratoons.	73 per cent.	14·47	84·6	7·00 ...	12·45 ...	Plant canes. (Latter part 1st December 1917). Compare these figures with those given below for analyses made some 16 or 17 days later on the same blocks.
VI	20th December 1917	Mixed plant canes...	74 ...	14·09	87	5·50 ...	11·86 ...	
VII	22nd December 1917	Striped Mauritius plant cane.	74 ...	14·15	86·1	7·16 ...	12·33 ...	
VIII	24th December 1917	Ditto ...	75 ...	13·85	83·6	5·58 ...	11·78 ...	
	25th December 1917	B. 147 plant cane...	75 ...	12·83	80·1	5·85 ...	11·09 ...	
	26th December 1917	B. 376 plant cane...	74 ...	14·68	87·9	7·40 ...	12·79 ...	

TABLE II—*concld.*

Block No.	Date.	Variety.	Juice expressed.	Sucrose in juice. Per cent.	Purity of juice. Per cent.	Sucrose in bagasse. Per cent.	Sucrose on cane. Per cent.	Remarks.
1	2	3	4	5	6	7	8	9
I	27th December 1917	Mixed ratoons ...	74 ...	16·25	90·6	Not estimated.	(13·93)...	
II	29th December 1917	Ditto ...	73 ...	15·72	91·4	Ditto ...	(13·48)...	
III	31st December 1917	Striped Mauritius ratoons.	74 ...	16·96	91·2	Ditto ...	(14·54)...	Ratoons. (End December 1917).
III	1st January 1918 ...	B. 376 ratoons ...	74 ...	16·81		Ditto ...	(14·41) ...	
IV	2nd January 1918 ...	B. 147 ratoons ...	73 ...	16·17	88·2	Ditto ...	(13·86) ...	
V	3rd January 1918...	Mixed plant cane and ratoons.	73 ...	13·74	81·2	Ditto ...	(11·78)	
VI	4th January 1918 ...	Mixed plant canes ..	75 ...	13·99	86·4	Ditto ...	(11·99) ...	
VII	5th January 1918...	Striped Mauritius plant cane.	76 ...	15·72	91·4	Ditto ...	(13·47)	
VIII	7th January 1918 ...	Ditto ...	73 ...	15·59	89·4	Ditto ...	(13·37) ...	Plant canes. (Early January 1917).
IX	8th January 1918 ...	B. 147 plant cane ...	73 ...	14·76	86·3	Ditto ...	(12·65) ...	
X	9th January 1918 ...	B. 376 plant cane...	74 ...	16·33	92·3	Ditto ...	(14·0) ...	

This gives an average sucrose content of cane milled of 13. 76 per cent.

In my opinion this figure is below the truth for our canes milled in the month of March, partly by reason of the fact that in many cases an interval of a few days occurred between delivering the cane at the factory and milling it.

In view also of the fact that a minimum expression of 70 per cent. of juice on weight of cane is always obtained with our canes using a small three-roller bullock mill (*vide* Table II), and that the 9 roller factory mills gave last year an expression of 70 per cent., it seems to me to be highly improbable that the figure of 64·3 per cent. derived from the factory records this year can be correct.

On the whole, very little information of either interest or value to the experiment is derivable from the records of the factory operations for the year under review.

12. *Extension area, season* 1917-18.—Reclamation commenced from the latter part of October 1917 and went on into April 1918. The total new area brought under cultivation was 155 acres. In addition 108 acres of land reclaimed last year were re-ploughed, cultivated, harrowed, drained and trenched. The operations consisted of the harrowing down of grass jungle previous to burning off ; ploughing, harrowing, cultivating twice followed by re-harrowing, draining and trenching for planting. The whole of the area was drained, as per scheme described in paragraph 11 of the report for 1916, previous to planting up.

13. *Planting of present crop.*—Planting commenced earlier than in former years, *i.e.*, towards the latter end of January and was not finished until the end of April 1918. In all some 233 acres new cane was planted, about 108 acres of this in Blocks 11 and 13 having been reclaimed 12 months earlier, the remaining 125 acres being reclaimed just previous to planting up. Of the land ploughed up 12 months previous to planting, Block No. 11 had in the meantime gone back into jungle it being found impossible to work it in the rains ; Block No. 13 was kept however in a fair state of cultivation throughout.

The total area under cane this year, plants and ratoons, amounts to just over 500 acres.

This year the precaution was taken of planting out reserve nurseries along the roadside for filling in vacancies later. On the whole germination this year is much better than last, and the young crop is doing well up to date and is well forward, with the exception of two blocks, Nos. 17 and 18, which were planted out very late at the end of the season.

The varieties of cane under cultivation are Striped Mauritius, and Barbadoes Nos. 147 and 376.

Up to the end of June, the ratoons had all been twice hoed, and the young plant cane twice weeded.

Up to the present crop prospects are more favourable than they were last year, and in the ordinary course of events bigger crops may be confidently expected.

14. *Cane nursery.*—Some 15 varities were grown in the nursery including Dr. Barber's red sport of striped Mauritius, Kamrup red sport of striped Mauritius, Java 247, Java 33a, Barbadoes Nos. 208, 6450, 3412 and Barbadoes A and B (numbers uncertain), White Bombai, Tanna, and W. M. Nos. 1, 2, 3 and 4.

Of the above Dr. Barber's red sport and Java 247 did very badly indeed for the second time and have been rejected as useless. The remaining 13 varieties are being nurseried again on a bigger scale this year, in addition to two other new varieties introduced last year by Mr. Maxwell, making 15 new varieties in the nursery in all in 1918.

The varieties showing most promise at present are, B 208, B 6450, B. 3412, J. 33a, Barbadoes A, White Bombai, Kamrup red sport of striped Mauritius, W. M. Nos. 2 and 3. Some of these will be planted out on a field scale in 1919.

15. *Other crops.*—The only other crops grown were *Dhaincha* (*Sesbanea Aculeata*) and Java Natal Indigo, both of which were grown for seed purposes.

Rain crops, 1918.—*Dhaincha* and cowpeas (*Vigna Catiang*) are being grown as green-manure crops on those blocks which came out of cane last season. In addition further areas are under *Dhaincha* and cowpeas for seed for next year's green-manuring programme.

About 2 acres of bamboos have been planted out, and nurseries of Nim and Gold Mohur trees commenced with a view to the provision of fuel.

16. *Expenditure.*—From 1st July 1917 to the 30th June 1918.

Kamrup Sugarcane Farm.

Heads.	From 1st July 1917 to 31st March 1918.	From 1st April 1918 to 30th June 1918.	Total.
1	2	3	4
	Rs. a. p	Rs. a. p.	Rs. a. p.
Establishment.			
Manager	8,800 0 0	3,000 0 0	11,880 0 0
Clerks	675 0 0	225 0 0	900 0 0
Compounder	270 0 0	90 0 0	360 0 0
Peons	270 0 0	90 0 0	360 0 0
Tackle Assistants	1,714 8 0	547 0 0	2,261 8 0
Muharrirs	405 0 0	135 0 0	540 0 0
Sugar Analyst	150 0 0	100 0 0	250 0 0
Total ...	12,364 8 0	4,187 0 0	16,551 8 0
Special Contingencies.			
Implements, machinery, etc. ...	3,609 11 0	51 0	3,660 11 0
Buildings	500 0 0	...	500 0 0
Fencing	...	1,155 8 0	1,555 8 0
*Breakage of machinery ...	5,505 12 0	...	5,505 12 0
*Dismantling and transport of machinery.	19,408 5 0	...	19,408 5 0
Total ...	29,023 12 0	1,606 8 0	30,630 4 0
Regular Contingencies.			
Feed of cattle	2,754 14 0	...	2,754 14 0
Seeds, plants and manures ...	313 6 0	8 7 0	321 13 0
Wages of labourers	24,346 1 0	11,732 12 3	36,078 13 8
Petty repairs...	4,751 4 10	66 0 0	4,817 4 10
Service postage	100 0 0	...	100 0 0
Unspecified charges	419 9 6	277 8 6	697 2 0
Cost of fuel	1,701 14 0	14 0	2,202 12 0
*Ditto	5,057 14 0	...	5,057 14 0
Stores, oil, etc.	1,774 3 0	...	1,774 3 0
Total ...	41,219 2 4	12,585 9 9	53,804 12 1
Grand total ...	82,607 6 4	18,379 1 9	1,00,986 8 1

* Items marked thus constitute special expenditure, sanctioned by Government to Mr. W. Maxwell in connection with the Factory, and amount to a total of Rs. 29,971-15-0.

Receipts.

	Rs.	a.	p.
By sales of sugarcane setts	718	6	0
By sale of cane to factory	2,063	0	0
Total ...	2,781	6	0

17. *Staff.*—The staff during the year consisted of—

		Rs.	
	Manager on	1,000	per mensem.
	Clerk on	75	„
Engine staff	One mistry on	55	„
	Three Engine drivers on ...	22	„
	Three 2nd Engine drivers on ...	18	„
	Two Engine attendants on ...	15	„
	One godown muharrir on ...	20	„
	One „ „ „ ...	25	„
	One compounder on ...	30	„
	Three peons on	10	„

18. *General.*—The Director of Land Records and Agriculture, Assam, and the Deputy Director of Agriculture, Assam Valley, visited the farm frequently throughout the year.

The general health has been good.

CAMP KAMRUP FARM,
The 17th July 1917.

A. A. MEGGITT,
Acting Deputy Director of Agriculture, Assam Valley.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN THE UPPER ASSAM VALLEY FOR THE YEAR ENDING 30TH JUNE 1918.

Staff.—Maulvi Fazlul Haq Ahmed, Superintendent of Agriculture, was in charge, assisted by two Inspectors and five demonstrators, one of whom however was only appointed on 1st June 1918. During the year the Superintendent of Agriculture was on tour for 246 days.

Sreejut Devi Prasad Gohain was placed in charge of the Sibsagar district after a preliminary training under the Kamrup Inspector, from the 15th November 1917, as Inspector, when Sreejut Golok Chandra Bora was transferred to Nowgong. He was on tour for 230 days.

Agricultural Inspector Sreejut Golok Chandra Bora was absent on 1 month's privilege leave during the year, and was on tour for 274 days.

2. *Demonstration work.*—Demonstrations were continued on :—

Paddy.—Manuring and variety demonstrations.

Sugarcane.—Distribution of superior varieties, green-manuring for cane, and the use of the three-roller iron crushing mill.

Potatoes.—Distribution of superior varieties.

Meston ploughs.—Use of.

Conservation of cattle manure.—Construction of covered pits.

New crops.—Trials of and distribution.

3. *Paddy.—Residual effect of bonemeal.*—Eight plots originally manured with bonemeal in 1915 were observed for 3rd year residual effect. The 1st and 2nd year's results appeared in

the two previous reports. The 3rd year results were as follows :—

Sibsagar District.

No.	Locality.	Grain in lbs. per acre.		Remarks.
		Bonemeal plots.	Untreated plots.	
1	2	3	4	5
1	Kachojan	Grain pilfered.		Rejected.
2	Parbatia	1,612	1,524	
3	Khongia	1,488	1,157	
4	Kakotigaon	1,423	1,225	
5	Ahomgaon	1,736	1,279	
6	Gorokhiya-dowl ...	1,242	1,344	
7	Dhai Ali	1,854	1,542	
8	Dheporgaon	1,154	1,222	

The average increase per acre of the bonemeal plots over the untreated plots is 174 lbs. grain.

Valued at Rs. 3 per maund (82 lbs.) this shows an average net profit of Rs. 6-6-0 per acre for the third year. The total net profit for the three years of the demonstration works out of Rs. 18-6-0 per acre; the initial expenditure for bonemeal in 1915 was Rs. 9 per acre, so that for an outlay of Rs. 9 per acre the cultivator may confidently expect to realise a net profit for Rs. 18 during the following three years. This confirms previous results.

4. *Second year paddy demonstrations.*—These were commenced in 1916 at several centres, one plot being then manured with either bonemeal or flour phosphate, 3 maunds per acre, the other being a check plot. The 1st year's results appeared in paragraph 5 of

last year's report. The second year's outturns, without further manure, are as follows :—

Sibsagar District.

No.	Locality.	Grain per acre, in lbs.		
		Bonemeal plots.	Flour phosphate plots.	Untreated plots.
1	2	3	4	5
1	Dergaon	...	1,157	984
2	Rahdhola	1,387	...	1,453
3	Parbatia	...	1,403	806
4	Murabazar	...	1,354	1,067
5	Bhojo	1,520	...	1,273
6	Longkak	972	...	848
7	Moleng	...	1,346	1,353
8	Patiagaon	...	1,045	1,353

The average increase due to bonemeal was 102 lbs. grain per acre, and to flour phosphate 150 lbs. per acre over corresponding unmanured plots. This again bears out our previous experience in the Sibsagar district that flour phosphate gives better results than bonemeal on the average ; see reports for 1916 and 1917. Whereas however flour phosphate was previously cheaper than bonemeal, it is now more expensive.

Reckoning the value of paddy at Rs. 3 per maund, the value of the increase due to bonemeal averages Rs. 3-12-0 per acre, while for flour phosphate it amounts to Rs. 5-10-0.

For the first year of these demonstrations, charging the whole cost of the manuring against the first crop, the result was a loss of Rs. 2 per acre in the case of bonemeal against a profit of Re. 1 per acre for flour phosphate. The net profit therefore for the first two years of these trials averages only Re. 1-12-0 in the case of bonemeal and Rs. 6-10-0 for flour phosphate. This is not such a good result as has been previously obtained in similar series of demonstrations ; it is certainly in my opinion not good enough to tempt the cultivator to lay out his money in these manures.

5. *New paddy demonstrations.*—During 1917 in each subdivision one new bonemeal demonstration was commenced, while new flour phosphate trials were started at two centres, one in the Jorhat and one in the Golaghat subdivision. At each centre one plot was manured with bonemeal or flour phosphate, 3 maunds per acre, the other being a check plot.

Sibsagar District.

No.	Locality.	Grain in lbs. per acre.		
		Bonemeal plots.	Flour phosphate plots.	Check plots.
1	2	3	4	5
1	Jalukani	1,902	...	1,603
2	Halikihat—Ahomgaon ...	1,914	...	1,798
3	Bailung	1,851	...	1,539
4	Napomua	...	1,686	1,612
5	Amolapatty	...	1,357	990

On the average, the increase due to bonemeal is 242 lbs. per acre of paddy valued at Rs. 9, and due to flour phosphate is 220 lbs. paddy per acre, value Rs. 8-4. Current cost including freight charges is about Rs. 3-4-0 per maund for bonemeal and Rs. 3-10-0 for flour phosphate. Thus the cost of neither manure is quite recovered on the first crop, there being a small loss of 12 annas per acre for bonemeal and Rs. 2-10-0 in the case of flour phosphate.

The second and third years' crops without further manure should show a fair profit.

6. *Combined phosphate and green-manure demonstrations for paddy.*—During 1917 combined experiments in the use of phosphates with and without green-manure were commenced at four centres in the Sibsagar district. At each centre there were six plots, *viz.*, no manure ; green-manure; bonemeal ; flour phosphate ; bonemeal *plus* green-manure ; flour phosphate *plus* green-manure. The plots were all about equal in size averaging $\frac{1}{5}$th acre each. The manures were applied before sowing the green crop which was ploughed in a week or two before transplantation of the paddy.

The results recorded were as follows :—

Grains in lbs. per acre.

No.	Locality.	Unmanured plot.	Bonemeal.	Bonemeal *plus* green-manure.	Flour phosphate.	Flour phosphate *plus* green-manure.	Green-manure.
1	2	3	4	5	6	7	8
1	Kakojan	923	1,553	1,705	2,025	1,793	1,553
2	Kowarpur	1,402	2,059	2,014	1,884	1,850	1,811
3	Sukanpukhari	838	...	...	1,325	1,427	1,248
4	Batiani	1,017	2,877	2,328	3,049	2,093	1,219

The results are somewhat inconsistent, and the increase due to bonemeal and flour phosphate is in most cases much more than has been recorded in the past with these manures. Such inconsistencies however must be expected in view of the fact that these demonstration centres have necessarily to be chosen in a more or less haphazard fashion and without any accurate previous knowledge of the history and treatment of the various plots.

Summing the results we arrive at the following :—

Average increase per acre for all centres due to	Grain, lbs per acre.
(*a*) Green-manure alone...	316
(*b*) Bonemeal	852
(*c*) Flour phosphate	1,002
(*d*) Bonemeal *plus* green-manure	870
(*e*) Flour phosphate *plus* green-manure ...	722

Though, while used alone, green-manure gives a very favourable average increase, when used with bonemeal or phosphate it does not appear from these results to add to the increase which these two manures give when used alone ; indeed in the case of flour phosphate the average result is worse when used with green-manure than when used alone. The results at any rate appear to leave no room for doubt that phosphate in some form is the prime requirement of the paddy crop at these centres.

7. *Paddy variety demonstration.*—Two trials of Mr. Hector's "Indra" and one of "George" *sali* were made against local paddies of similar classes in each subdivision. The results are given below :—

Number.	Locality.	Plot number.	Variety.	Yield of grain per acre.	Remarks.
1	2	3	4	5	6
				lbs.	
1	Baghmariagaon...	I	Indra sali ...	860	
		II	Suagmani ...	1,010	
2	Sonarigaon ...	I	Indra sali ...	1,119	
		II	Jahinga ...	768	
3	Khelmati ...	I	George sali ...	1,846	
		II	Jal sali ...	1,488	
4	Halikihat Ahomgaon.	I	Indra sali ...	1,274	
		II	Sokoa	1,053	
5	Jogigaon ...	I	Indra sali ...	1,594	
		II	Sokoa sali ...	1,370	
6	Simoluguri ...	I	Indra sali ...	2,330	
		II	Jahinga ...	2,563	
7	Serekapar ...	I	Indra sali ...	2,287	
		II	Rangabora ...	1,895	
8	Simoluguri ...	I	George sali ...	1,535	Site unsuitable for George *sali*.
		II	Ronga sali ...	2,181	

It will be seen that out of six trials Indra *sali* has beaten the local variety in four cases in the case of one centre No. 6 at Simoluguri, the site chosen was too low for Indra *sali*. Neglecting this centre, Indra *sali* has given an average increase of 208 lbs. paddy grain per acre over local varieties, though the yields at four centres are not comparable with the heavy outturns reported from Bengal for Indra *sali*.

George *sali* beat the local variety at one centre but not at another ; in the latter case the site was unsuitable, being too high for this veriety which likes a fairly low site and fairly well of water.

A good many more trials of these verieties will be necessary in Assam before their superiority is definitely proved.

8. *Demonstrations with superior varieties of sugarcane.*—Two new demonstrations were started in each subdivision. The yields of *gur* per acre obtained, as well as those for the ratoons of the previous year's demonstrations, are given below :—

Number.	Locality.	Yield of *gur* per acre, in lbs.		Remarks.
		Improved canes.	Local canes.	
1	2	3	4	5
1	Goromur	5,566	4,866	Plant canes.
2	Arundhara	5,309	3,473	
3	Kamargaon	2,240	1,256	
4	Charingia	2,933	2,178	
5	Demow	1,825	1,455	
6	Namtiali	1,403	1,563	
	Average yield ...	3,213	2,465	
	Increase per acre plant cane ...	748		
7	Khatoal	1,846	1,099	Ratoon crop.
8	Ahompathar	1,994	709	
9	Somdorgaon	1,640	798	
10	Chinatoli	1,256	575	
11	Barkathoni	1,029	877	
	Average yield ...	1,553	812	
	Increase per acre—Ratoons	741		

On the whole with one or two exceptions these results are poor, and lower than have been recorded from similar demonstrations in the past. While for both plant canes and ratoons the results show an average net profit per acre in favour of the introduced varieties of some Rs, 47, considerably higher outturns

should be possible. It is the fact that cultivators can hardly be persuaded to give our improved varieties of cane the better cultivation and little extra care and manure which they demand and will undoubtedly pay for. More particularly this applies to the ratoon crop, upon which ryots will usually spend no money in manure or labour in cultivation. It is my considered opinion that the mere distribution of improved varieties will effect little improvement in itself. Under the treatment at present meted out to them by the ryot these canes will degenerate.

Finally, I am convinced that unless we can persuade ryots (*a*) to put in more cultivation, (*b*) to adopt some sort of a rotation, including a green-manure crop once in four or preferably three years (*c*) to plant earlier, (*d*) to select carefully planting material and (*e*) to manure more heavily, there is little hope for much permanent improvement in cane culture in Assam amongst the cultivators.

Green-manuring for cane.—This was demonstrated at four centres, cowpeas being grown and hoed in in the year previous to planting cane, the local variety being grown on both the green-manured and check plots at each centre.

Number.	Locality.	Yield of gur in lbs per acre.		Remarks.
		Green-manured plot.	Check plot.	
1	2	3	4	5
1	Charaibahi	4,880	3,307	Kolapura cane.
2	Khongia	3,245	2,805	Magh cane.
3	Gharkatiya	5,475	5,203	Ditto.
4	Chinatoli	1,906	1,452	Ditto.
	Average ...	3,876	3,214	
	Increase due to green-manure...	662		

This increase of 662 lbs. *gur* per acre at Rs. 5 per maund is worth some Rs. 40, this profit being obtained at a cost of Rs. 4-8-0 per acre for Cowpea seed.

Three-roller iron crushing mill.—Seven of these mills were used throughout the district for carrying out demonstrations.

Practical tests of the mill were made at several centres against the ordinary country wooden mills, using an equal weight of cane for either mill, noting the time of crushing and weighing the juice and *gur* obtained. On the average the iron mills crushed a given weight of cane in three quarters of the time that was taken by the country mill, and the increase in *gur* obtained amounted to 22 per cent. The average attendance of cultivators at these tests was 22.

Distribution of cuttings of superior cane varieties.—The demand for our canes is growing so fast, that to augment the supply of cuttings small centres for growing improved varieties were established by arrangement with cultivators in the districts.

The total number of cuttings disposed of for demonstration and distribution purposes was 309,000 derived as follows :—

Jorhat Farm	...	...	1,16,000
Demonstration centres	...	...	9,000
Srijut Deveswar Barthakur, Thakurbari Farm	...	...	44,000
Srijut Loknath Hazarika, Panidihing;	...	...	10,000
Srijut Deveswar Goswami, Gossainbari Farm	...	...	5,000
Kamrup Farm	...	...	1,25,000

It may be remarked that the varieties of cane we have been distributing now for the past few years, Striped Mauritius, B147 and B376, may now be found scattered over the districts, *i.e.*, in the Bokota and Panidihing mauzas, Kakwa, Somdor and Metaka villages in Sibsagar, in the villages of Khongia, Arundhara and Parbatia, etc., in Jorhat, and in Kamargaon on the banks of the Dhansiri; in Gharkatiya and Badulipar; and in Bokajan, Seelonijan, Kerdoiguri and Naharance in newly opened tracts in the Nambor Forests.

9. *Potatoes, superior varieties.*—Ten demonstrations were made to compare Shillong seed with Local bazar seed,

"Magnum Bonum" from the Shillong Farm was the variety used. The yields per acre were as follows :—

No.	Locality.	Shillong seed.	Local seed.
1	2	3	4
		Tons.	Tons.
1	Kakila-Kumargaon	4·0	3·1
2	Nokari-Bamungaon	2·9	0·7
3	Simoluguri	2·0	0·9
4	Kuarghat	6·0	1·7
5	Amguri	6·7	1·2
6	Kuarpur	1·7	2·0
7	Gelabil	1·3	1·0
8	Kamargaon	7·9	4·2
9	Mahuramukh	8·9	3·9
10	Gelabil	3·6	2·7
	Average ...	4·5	2·14

These ten demonstrations show an average increase of crop in favour of the Shillong seed of some 2·3 tons per acre which at Rs. 70 per ton represents a money value of Rs. 161 per acre. This is discounted to some extent by the fact that on account of the larger size of the Shillong seed and the objection on the cultivators' part to cutting them, much more seed of the Shillong variety is necessary to plant a given area. Thus to plant an acre of Shillong potatoes often costs Rs. 75 for seed alone, and if the potatoes are very large the amount would be more, whereas for small local seed the cost per acre for seed would not often exceed Rs. 10.

Inspite however of this the demand for Shillong seed far exceeded the supply and many prospective buyers were disappointed. Some 113 maunds potatoes were sold for seed at Rs. 5 per maund in the Sibsagar district, whereas 500 maunds could easily have been sold had it been available.

10. *Meston ploughs.*—These ploughs were demonstrated in several centres with some success. Their cost seems to be against them in this district.

11. *Conservation of cattle manure.*—The construction of model manure pits in villages was continued. During the year 2 were erected in Jorhat, 91 in Golaghat and 32 in Sibsagar.

12. *Demonstration work done by Honorary Correspondents.*—Some of the Honorary Correspondents of the Department rendered valuable assistance in one way or another during the year, and our thanks are due to them for their interest in popularising our efforts.

Srijut Deveswar Barthakur and Srijut Deveswar Goswami who have been extensively cultivating our improved canes for some years helped us by distributing large numbers of cuttings to cultivators as mentioned previously in this report. The former carried out some very successful experiments with Joha paddy, a fine scented variety.

Srijut Narayan Barua distributed much "George sali" seed.

Maulvi Zubaid Ali Hazarika was very successful with Shillong potatoes; he also grew "George sali" and demonstrated the superiority of our Barbadoes sugarcanes on his farm.

Srijut Baikuntha Narayan Barua and Srijut Pithubar Saikia also experimented with paddy on their holdings.

Babu Jnan Chandra Roy considerably extended the cultivation of Barbadoes canes which have been giving uniformly good results. He also distributed a certain number of cuttings of Barbadoes canes free of charge to neighbours.

13. *Demonstration work in Nowgong.*—An opening was made with demonstration work in the Nowgong district during the year. No Inspector was available till towards the end of the year, for the greater part of which we had to work with one Demonstrator stationed at Kampur. Unfortunately this man proved utterly unreliable and was dismissed subsequently. Under the circumstances proper supervision being impossible, very little was effected.

Paddy.—Manurial and variety demonstrations on paddy were laid down, but the results for one cause or another proved quite unreliable. However the cultivation of "George" and "Indra" *sali* is extending, and "Boro" paddy was grown successfully in several localities in Uttarkhola mauza.

Potatoes.—To introduce this important crop five demonstrations were arranged. The crops did well, but were pilfered to such an extent from the plots that weighment was useless.

Sugarcane.—Small areas of Barbadoes canes were planted up at Dharamtul, Chaparmukh, Lanka and Kampur with a view to providing material for conducting proper demonstrations in the future. At the two former centres these failed through negligence on the part of the cultivators concerned; at Lanka

the crop was ruined by wild animals, while at Kampur a portion of the crop was ruined by an elephant and the remainder which grew excellently was completely lodged by a storm while immature. Some 18,000 cuttings were sent from Jorhat in April 1918, but these are again reported to have germinated badly from delay in transit and other causes. A scheme under which the Nowgong Jail was to grow 2 acres of our canes for future distribution fell through unfortunately at the last moment, owing to changes there connected with the outbreak of *hat* looting.

Iron crushing mills for sugarcane.—These three-roller mills were demonstrated at Atigaon, Charaibagi, Rangalu, etc. Iron mills of a two-roller type have however been in use in the district for some time; the three roller mill is however more efficient.

Meston ploughs.—This plough was demonstrated at Singrimari, Rangalu, Nijkampur and other centres.

Conservation of manure.—In this district covered sheds are being advocated, the country generally being too low for pits.

JORHAT:

The 23rd August 1918.

A. A. MEGGITT,

Agricultural Chemist to the Assam Administration.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN KAMRUP DISTRICT FOR THE YEAR ENDING THE 30TH JUNE 1918.

The agricultural demonstration work in this district, together with the Seed Depôt, Gauhati, were in charge of Babu Satyendra Chandra Datta, Agricultural Inspector, Kamrup, throughout the year. He is under the guidance and control of Maulvi Abdul Fazlul Haque Ahmed, Superintendent of Agriculture, Assam Valley, and is assisted by three Demonstrators with headquarters at Nalbari, Gauhati, and Palasbari, respectively.

Satyendra Babu remained in charge throughout the year, except for a period of 45 days which he spent on privilege leave, and a period of ten days in November, during which he visited the plains districts of the Garo Hills to advise on the possibility of *Boro* paddy cultivation there.

The third Demonstrator, Sheikh Umar Ali, was appointed to the Palasbari circle from the 1st of November last. The other two demonstrators, Srijut Biswa Nath Dutta and Srijut Chandi Charan Dutta, were confirmed in their appointments as demonstrators, Gauhati and Nalbari, respectively.

The Agricultural Inspector was on tour for 198 days.

2. Demonstration work was continued on similar lines to that of the previous year, and was extended to new portions of the district previously untouched. The points to which attention was principally devoted were :—

(1) Manuring and variety demonstration with paddy.

(2) Variety trials of sugarcane, and demonstration with three-roller iron mills, and distribution of cane sets of improved varieties.

(3) Variety trials of superior varieties of potatoes and distribution of seed potatoes.

(4) Jute demonstrations.

(5) Trials of fodder and a few miscellaneous crops.

(6) Introduction of Meston ploughs.

(7) Conservation of cattle manure.

3. *Manuring of the rice crop.*—(1) This work was started in 1913, but the demonstrations begun in that year gave very irregular results and proved of little value. Demonstrations laid down each year since that time have given better results. The selected

lands were manured with bonemeal, at 247 pounds per acre, and the paddy crops weighed each year for three years, and compared with those of the neighbouring unmanured plots. A second application of bonemeal is being given at the end of the three years. This is for the purpose of testing whether or not the effect of the first application has been exhausted in that time, and if a second application will again produce a profitable increase in the crop.

At Chakchaka half of a plot, which was treated with bonemeal in 1913, was again redressed in 1916. The second year's results have been recorded, and shew an increase of 506 lbs. per acre from the second application, over that obtained from the plot originally manured in 1913.

Another plot at Parakuchi which received bonemeal in 1914 was again redressed in 1917. The first year's results have been recorded and shew an increase of 619 lbs. grain per acre from the redressed plot.

4. *Third year demonstrations.*—Five centres were manured with bonemeal in 1915 and were kept under observation since. Owing to the produce being mixed in one of these demonstrations the results had to be discarded. The remaining four gave the following results :—

Yield of grain per acre, in pounds.

—	Bonemeal plots.	Untreated plots.	Remarks.
1	2	3	4
1. Nalbari	898	676	Ahu crop only.
2. Gobindpur	583	478	Sali crop only.
3. Palasbari	1,115	891	Ditto.
4. Uparsali	1,553	1,122	Ditto.

The average increase per acre on the manured plots came to 245 pounds and, as there was a substantial profit in the first two years from the increase then produced, this series of demonstrations may be considered quite satisfactory.

5. *Second year demonstrations with green manure used alone and also in conjunction with bonemeal.*—Dhaincha was the green manure used, and bonemeal was applied at 247 pounds per acre. The results were as follows :—

Yield of grain per acre in pounds.

Locality.	Green manure plots.	Green manure and bonemeal.	Untreated plots.	Remarks.
1	2	3	4	5
Tongra	2,985	3,420	3,387	Sali only.
Koira	1,350	1,399	1,023	Ditto.
Nalbari	2,709	2,592	2,593	Ahu and sali.
Sorbhog	1,740	1,415	1,598	Ditto.

This shows an average increase of 45 pounds from the green manure, and of 49 pounds from the combined application of bonemeal and green manure. As the increases were respectively 16¼ and 301 pounds in the previous year, the total increase for the two years amounts to 209 and 350 pounds, obtained by an expenditure of Rs. 1-8-0 for the green manure seed, and of Rs. 10-8-0 for the bonemeal and green manure. These demonstrations will be continued for a third year.

6. Similar demonstrations were started at Sandheli, Dharamtola, Nayagaon, Rangamati, Sarpara and Beltola, in the year under report. Results from five of these centres in the first year were as follows:—

Yield of grain per acre in pounds.

Locality.	Green manure.	Green manure and bonemeal.	Untreated.	Remarks.
1	2	3	4	5
Sandheli	1,880	2,059	1,830	Sali crop.
Dharamtola	1,751	1,766	1,525	Ditto.
Nayagaon	2,222	2,089	1,640	Ditto.
Rangamati	1,473	1,945	1,526	Ditto.
Sarpara	1,429	1,818	1,499	Ditto.

The average increase from green manure, costing Rs 1-8-0, is 183 pounds per acre and from the application of bonemeal and green manure, costing Rs. 10-8-0, the average increase per acr is 411 pounds. The somewhat irregular results detract from the value of these demonstrations, still at normal prices for paddy these would be satisfactory returns, and as considerable increases may be expected on the manured plots for another two years, the use of these manures is to be recommended.

7. *Manuring demonstrations with oilcake* .—These were tried at three centres with satisfactory results :—

Yield of grain per acre in pounds.

Locality.	Manured with oil ake.	Untreated.	Remarks.
1	2	3	4
Sandehli	2,222	2,019	*Ahu* and *sali* crops.
Dohali	3,513	2,735	Ditto.
Sadlipar	2,304	1,950	Ditto.

Oilcake was applied at approximately 500 pounds per acre, costing Rs. 10-8-0, and has produced the satisfactory increase of 462 pounds per acre. Oilcake is a home product available over the greater part of the district, and is usually sold to outside dealers at a very low price, instead of being fed to cattle or used directly as a manure. In view of the above satisfactory results, and with the hope of persuading the raiyats to abandon their present short sighted policy, we are extending these demonstrations in the present year.

8. *Demonstrations with improved varieties of paddy.*—Indra *sali* was tried against local *sali* at five centres, and George *sali* at six centres in the district. and the following results were recorded :—

Locality.	Indra sali.	Local sali.	Remarks.
1	2	3	4
Beltola	2,934	2,873	
Chutiapara	2,698	2,398	
Noonmati	2,127	1,811	
Baroma	...	...	Produce mixed.
Doula	...	...	Ditto.

This gives an average yield of 2,586 pounds per acre from Indra *sali* against 2,360 pounds of an average from the best local varieties.

Locality.	George sali.	Local sali.
1	2	3
Beltola	1,548	1,113
Changsari	2,510	2,002
Noonmati	2,585	1,993
Bilpar	1,760	1,773
Ruparbathan	1,995	1,773
Balikusia	1,633	532

The average yield from George *sali* in these tests shows an outturn of 2,005 pounds per acre, as against 1,151 pounds from the heaviest yielding local varieties.

The cultivators have been impressed with the superiority of these varieties to the local kinds, and a large demand for seeds is expected next year.

Boro paddy.—This variety of spring rice was introduced in the *rabi* season of 1915 from Sylhet, and since that time a small quantity has been grown in suitable districts. During the year 21 maunds 20 seers of *boro* seed paddy were sold in the district.

Gandhi and *parang*, late transplanted and late broadcasted paddy varieties, respectively, were procured from Bengal, and five maunds of these were distributed by the Deputy Commissioner to cultivators in mauza Katha, through Srijut Pratap Narayan Chowdhury, Mauzadar. In a few cases they have been successful. The special quality which commends these varieties to the cultivators is that they are late-growing varieties, and may be sown after the subsidence of flood water, when the season is too far advanced for the ordinary varieties.

A fine *aus* paddy, obtained from the Central Provinces five years ago, has been much appreciated by the cultivators who have tried it. As there is a steady (though comparatively small) demand for the seed, arrangements have been made to stock locally grown supplies in the Seed Depôt.

9. *Demonstrations with superior varieties of sugarcane and improved cane crushing mills.*—At seven centres varietal demonstrations were carried out. Although considerable quantities of the best canes were pilfered from the plots of improved

varieties the yields were much greater than those obtained from the local varieties. Owing to late planting followed by drought, the crop at Nath Kuchi was poor and the comparative crushing test was therefore not carried out in this case. The results obtained at the other six centres were as follows:—

Yields of gur *in pounds per acre.*

Locality.	Improved variety.		Local variety.	Remarks.
1	2		3	4
Gabindpur	2,938	B. 376	978	Ratoon crop
Dharamtala	3,155	,,	1,792	Some canes.
Changsari	4,416	,,	3,357	Pilfered
Murara	1,880	Stripped Mauritius.	951	,,
Kathiamari	3025	,,	2,857	,,
Kamalpur	3,809	Striped Mauritius B. 147	3,526	,,
Rangamati	1,910	B. 376	1,051	...
Nath Kuchi	...	...	...	Crop failed.
Average yields ...	2,932	...	1,972	...

This increase of almost 50 per cent. is very satisfactory indeed. The system of taking a Ratoon crop from sugarcane has never been generally adopted by cultivators in this district, because most of the Deshi canes only give a small number of shoots in the second year. As a result of this character of the country canes, the usual system is to take only the one crop and to plant afresh each year.

Our demonstrations with the improved canes have shown that, not only can a much better crop be obtained in the first year, but that an excellent Ratoon crop can be grown in the second year, provided the sets are properly planted at the beginning, and that they get a reasonable amount of cultivation and manuring.

Cultivators are slow to adopt the ratooning method as it is contrary to custom, and, therefore, any ratoon crop must be well

fenced and protected from cattle if it is to have a reasonable chance of success.

The improved canes used were Striped Mauritius, B 147, and B 376. The superiority of these varieties to local kinds has now been thoroughly established in all parts of the district, where we have been able to carry out demonstration work. This is proved by the fact that in 1915, 13,000 cane sets were sold, in 1916, 65,008, and in 1917, 1,14,600. Even a larger number could have been disposed of had sufficient funds been available. In order to increase the supply of sets next year, and to economize in cost of carriage and handling, a system of giving sets to cultivators, who would undertake to return an equal number in the following season, was adopted. In addition to the sets sold and distributed as above, 14,000 sets were given free for demonstration purposes.

10. *Demonstrations with iron three roller cane-crushing mills.*—The demonstration were continued successfully with five mills, and in addition 8 mills were sold in the district. Previously these mills could be sold at Rs. 65, but last year the price rose to Rs. 80, and as it seems likely to be higher in the present year, sales are not likely to expand.

Distribution of Shillong potatoes.—(1) Nine demonstrations were laid down to compare seed potatoes as supplied by the Upper Shillong Farm with local and Khasi mixed seed as ordinarily sold in the bazars. Although at several centres our improved varieties suffered from pilfering, the yields were greater in every case than those of the local or Khasi mixed seeds. The results from six centres were :—

Yields in pounds per acre.

Locality.	Shillong seed.		Local seed.	
1	2		3	
Agytari ...	16,123	King of potato	15,468	Khasi mixed.
Raha	19,841	"	17,746	
Sorbhag ...	12,831	"	5,973	Deshi.
Gabindpur ...	14,580	"	9,050	"
Nath Kuchi ...	5,581	"	1,704	"
Sandheli ...	6,891	"	3,717	Patnai.
Average ...	12,641		8,948	

These demonstrations show in every case an increase of crop in favour of the Shillong seed, the average increase being 3,696 pounds—1 6 tons. Valuing the increase at Rs. 63 per ton this gives an increased money value of Rs. 100 per acre.

(2) *Potato-spacing experiments and experiments with different sized seed potatoes.*—Two of each of these experiments were arranged but the results are not conclusive. A larger number of such experiments will be laid down in the coming year.

(3) *Distribution of superior varieties of seed potatoes.*—About 100 maunds of seed of the Shillong varieties were sold to cultivators in the district at a cash price of Rs. 5 per maund. This price only just covered the cost of sacks, freight, and actual cost of distribution, and allowed Shillong bazar price for the potatoes.

12. *Jute demonstrations.*—Further trials with Kakaya Bombai and Assam Barpat, selected by R. S. Finlow, Esq., Fibre Expert, Bengal and Assam, were carried out to compare these with local varieties. The results were as follows:—

Yields of Fibre in pounds per acre.

Locality.	Local veriety.	Selected variety.
1	2	3
Sadilapar	1,142	2,011 Kakaya Bombai.
"	...	1,617 Assam Barpat.

The demand for the seed of Kakaya Bombai jute was much greater last year than in previous years. Being unable to get sufficient seed from the Bengal Department for our requirements in 1916, arrangements were made with local gentlemen to grow seeds of this variety for distribution. Maulvi Tayab Ali, Honorary Correspondent of the Department, and Babu Jyotish Chandra Chakravarty were sufficiently enterprising and public spirited to undertake this work, and the thanks of the Department are due to them for supplying a sufficient quantity of seed for almost the whole of the past year's requirements in this district.

A number of half-pound packets of this improved jute seed was distributed through the Deputy Commissioner, by means of the village organizations recently established in the district. This method has the double advantage of popularizing the improved jute and of bringing the village authorities in touch with Agricultural improvements.

13 *Trial of fodder and miscellaneous crops.*—A mixture of jower and cowpeas was grown successfully at Rampur. Cowpea gave fair crops at Sorpara, Dohali and *jowar* at Jhalukbari and Barbhala. The cultivators do not yet show any interest in the cultivation of fodder crops.

Pusa wheat No. 6 was tried at two centres. At one centre the crop was injured by cattle, and at the other by insects, so no crop was obtained. A crop grown at Nilpur from bazar seed gave an outturn equivalent to 1,121 pounds per acre. Barley, *masur*, *sonamug* gave 607, 345 and 330 pounds per acre, respectively.

Gram was tried at three centres and proved unsuccessful. Mustard demonstrations were seriously damaged by aphides and gave no satisfactory results.

Cotton was formerly grown in the district to a certain extent but gradually went out of cultivation in recent years. Owing to the increase in price of yarns and cloths, great interest is being exhibited by local people in the possibility of a revival and extension of its cultivation. Although it is not likely that the cultivation of this crop will ever reach important proportions in the district yet it was considered desirable that arrangements should be made to procure seed for interested parties. Garo cotton, *barkapas* and *juti kapas* seeds were supplied to cultivators in the district, principally at Nalbari and Kamalpur.

14. *Introduction of Meston Ploughs.*—Demonstrations were continued with success, and nine ploughs were sold during the year. Owing to recent increases in price the sale of these implements is not likely to extend so rapidly as it otherwise would have done. A few plough shares were sold during the year, which shows that the ploughs already purchased have not been kept idle.

15. *Conservation of cattle manure.*—Thirty-two covered cattle manure pits were prepared in the past year. Twenty-eight of these were erected by the influence of Demonstrator Srijut Biswa Nath Dutt, and two each by Demonstrators Srijut Chandi Charan Dutt and Sheik Umar Ali. In Bhajali circle the necessity for erecting covered pits is not felt, as the cultivators keep their cattle on a *machan* (bamboo platform) and allow the manure to accumulate below until it is removed to the land. Credit is again due to Demonstrator Srijut Biswa Nath Dutt who has continued to show energy and activity in developing this work.

Shillong,
The 6th September 1918.

J. W. McKAY,
Deputy Director of Agriculture, Assam.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN KHASI AND JAINTIA HILLS AND GARO HILLS DISTRICTS, FOR THE YEAR ENDING THE 30TH JUNE, 1918.

1. During the year U Harry Singh was in charge of the Demonstration work in the hills. He was assisted by four demonstrators, headquartered at Shillong, Mauphlang, Umran and Jowai, respectively, and by one demonstrator with headquarters at Tura in the Garo Hills.

2. *Rice.*—The majority of rice-growers in the district have realised the value of bonemeal for wet-land paddy. Fresh demonstrations have therefore been reduced from 5 in the previous year, to 2 in the present year. As in previous years two plots, each about $\frac{3}{4}$ acre in area were taken at each centre. One was manured with bonemeal at the rate of 247 lbs. per acre, and the other left untreated as a check.

The first year's results are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mynthloo ...	Sahmaji ...	1,093	712	381
2	Pamra ...	Myllon Dykhar ...	1,200	705	495
		Average yield per acre.	1,146½	708½	438

The average increase in crop due to bonemeal is, therefore, 438 lbs. per acre. Valuing this grain at Rs. 3 per maund of 80 lbs. and the bonemeal at Rs. 4-8, the net profit per acre works out at Rs. 2-14-9 for the first year of application. Any increase obtained in subsequent years will be pure profit, and experience shows that bonemeal favourably affects the crop for

at least three years. These plots are being kept under observation as to the second and third years' results of the initial dressing of bonemeal.

Second year demonstrations.—The five demonstrations laid down in 1916, of which the first year's result appeared in last year's report, were kept under observation without further manuring, and the results of the second year appear below :—

No.	Locality.	Cultivators.	Yield of grain per acre.		Increase in lb. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Nongthymmai ...	U Nori ...	1,212	908	304
2	Lumpengdeng ...	U Hinmoney ...	1,533	1,215	318
3	Mawthoh ...	U Khai ...	1,913	1,548	365
4	Um-iap ...	Ka Nesi ...	1,296	1,071	225
5	Myriaw... ...	Siem Myriaw ...	1,218	1,001	217
		Average yield per acre.	1,434	1,148	286

This average increase of 286 lbs. is worth Rs. 10-11-7 at current prices.

These demonstrations yielded an average net profit of Rs. 3-9 per acre in the first year, after charging the entire cost of bonemeal to that year. The total net profit per acre from the first two years of this series of the demonstrations, therefore averages Rs. 14-5-5.

Third year demonstrations.—The 20 centres commenced in 1915, of which the first and second year's results appeared in the reports for 1916 and 1917, were kept under observation for the third year. At five centres the demonstrations were injured by floods, and in one centre not cultivated through the owner's illness, and they are therefore neglected.

The following yields were obtained from the remaining fourteen demonstrations :—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mawsyirih ...	Mrival ...	...	...	Not cultivated.
2	Umjapung ...	Klat ...	1,623	1,341	282
3	Umselang ...	Poet ...	1,590	1,491	99
4	Umsaw ...	Biang ...	1,748	1,608	140
5	Mawrong ...	Kpa Ka Sen ...	1,350	1,163	187
6	Nonglakhiat ...	Bha ...	1,050	909	141
7	Mawsiatkhnam ...	Kalicharan ...	1,004	900	104
8	Umthuh ...	Nimor ...	...	...	Damaged by flood.
9	Rambras ...	Hari Siem ...	1,112	1,004	108
10	Nonspeng ...	Kpa Silibon ...	852	760	92
11	Nongur ...	Kir Lyngdoh...	1,294	1,080	214
12	Laitdom ...	Morkin ...	1,170	1,009	161
13	Khliehtyrshi ...	Kpa Manik ...	897	619	278
14	Rambrai ...	Wanborch ...	703	603	100
15	Kyndongtuber ...	Kpa Ka Ksel...	1,080	900	180
16	Mawdemnai ...	Kpa Isaiah ...	1,520	1,360	160
		Average yield per acre.	1,214	1,053	161

These fourteen centres show an average increase of 160 lbs. of grain from the plots manured with bonemeal. This at current rates is worth Rs. 6. These centres showed an average net profit per acre of Rs. 19-2-7 for the first two years. The total net profit for the three years for which these demonstrations have been carried on is, therefore, Rs. 25-2-7, on an initial expenditure of Rs. 15 per acre.

During the year fresh demonstrations with bonemeal for upland paddy have been carried out in 12 centres, ten centres being situated in the Jowai subdivision and one centre in each of Mauphlang and Shillong circles. The selected plots were as nearly as possible $\frac{1}{8}$th acre each. One plot was manured at the rate of 247 lbs. per acre and another was left untreated for comparison.

The results of the demonstrations at two centres, *viz.*, at Umpyut and at Mawstem were not recorded.

The results obtained from the remaining ten centres from the first year's crop are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lbs. per acre.		Increase in lbs per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mylliem ...	U Jawoon ...	444	389	55
2	Umlyngka ...	U Thon ...	790	637	153
3	Khlihtyrshi ...	U Tram Dkhar...	448	352	96
4	Pynthorlangtein ...	U Dabid ...	365	186	179
5	Umlane... ...	U Sing ...	489	363	126
6	Mawphlang ...	U Manik ...	382	296	86
7	Demthring ...	U Kat ...	306	255	51
8	Jalong	U Jata ...	487	348	129
9	Shyrmang ...	U Suna ...	400	224	176
10	Rymbai... ...	U Doloi ...	640	289	351
11	Mawstem ...	Ka Bi ...	...	...	Destroyed by cattle.
12	Umpyut ...	U Rang ...	...	...	The crops were mixed up.
		Average yield per acre.	475	334	141

As might be expected, the effect of bonemeal on dry land paddy is not so marked in the year of application, as it is in the case of wet-land paddy. From the average results obtained in these ten

demonstrations it will be seen that 247 lbs. bonemeal has produced an extra crop of 141 lbs. of grain. This is not sufficient to pay the initial cost of manure, however it is proposed to weigh the produce for two more years.

Second year demonstration.—The 15 centres commenced in 1917, of which the first year's results appeared in the report of last year, were kept under observation for the second year.

At eight centres the owners of the lands on which demonstrations were made were unwilling to continue the demonstrations, as little effect was seen on the first crop. The results obtained from the remaining seven centres for the second year are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mawroh ...	Sabu Roy ...	42	336	84
2	Marbisu ...	Kpa U Hamu ...	394	370	24
3	Mylliem ...	Ka Jim ...	548	389	151
4	Umjajao ...	U Hon ...	498	340	158
5	Langlibun ...	U Sahon ...	506	372	134
6	Pamra	U Thma ...	391	278	113
7	Mihmyntdoo ...	U Muni ...	434	330	104
		Average yield per acre.	454	345	109

From the above figures, and taking the average results obtained from these demonstrations for the first and second year, it will be found that 247 lbs. of bonemeal produced an extra crop of 351 lbs. of grain, which is not sufficient to pay the initial cost of the manure. Should no better results be obtained from future trials, it will be hopeless to expect cultivators to use manure which will not repay its cost even in the second year.

In order that definite information may be gained it is intended that these trials shall be repeated in the following year.

As reported last year, at one centre in each of Shillong, Mauphlang and Jowai circles, a former demonstration was redressed with bonemeal. These demonstrations were manured with bonemeal in 1914, and received no manure in the intervening years. The effect of this second dressing of bonemeal on the second year's crop will be seen from the accompanying table.

No.	Locality.	Cultivators.	Yield of grain in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plots.	Untreated plots.	
1	2	3	4	5	6
1	Shangpung ...	Smon Dhar ...	1,320	914	406
2	Umlyngka ...	Kpa Ka Kwai ...	2,019	1,634	385
3	Mairang ...	Kmie Ka Selina ...	1,590	1,063	527
	Average		1,643	1,203	440

These results indicate that a second dressing of bonemeal, applied three years after the first dressing, will give a profitable return. The average total increase obtained in the first and second year from the second application was 747 lbs. Valuing the grain at Rs. 3 per maund and the bonemeal at Rs. 4-8, the net profit per acre works out at Rs. 14-8-0, and it is expected that an additional increase may be obtained in the third year also.

3. *Bone-crushing operations and bonemeal distribution.*—The total receipt of raw bones during the year was 10·10 tons. From this 6·32 tons were ground and 5·67 tons of bonemeal were produced. During the year a consignment of 40·36 tons was purchased in Calcutta and brought to Shillong and Jowai: thus making a supply of 46·03 tons of bonemeal available for distribution in the Hills Districts.

This was distributed as follows:—

	Tons.
Used at the Upper Shillong Farm	·80
For demonstrations in the Hills	·56
Exchanged for raw bones	1·38

	Tons.
Sold at the Farm	2·49
Sold at Shillong	10·78
Sold at Jowai	29·19
Sold to Honorary correspondents	·22
	42·68
Balance available at the farm	·11
Total	46·03

This quantity of 42½ tons, or approximately 1,200 maunds of bonemeal was sold to cultivators in the Hills Districts during the year at an average price of almost Rs. 5 per maund.

The importance of the work may be realized when it is stated that the cultivators paid in cash, a price which covered all expenses including cost price at Calcutta, all freight charges, and a small profit to the person who acted as agents for our Department, in transporting and retailing the manure. It speaks volumes for the integrity of the Hill people that there were no bad debts throughout.

The greater part of the material had to be brought by country boat from the Railway station at Sylhet to the foot of the hills, a distance of 40 miles or so—and then carried by manual labour for over 30 miles up the hills to Jowai, which was the main centre of distribution.

The Agricultural Inspector, U. Harry Singh, exhibited great energy and resourcefulness in getting this part of the work done promptly and at reasonable rates. Had it not been for his exertions it would have been impossible to carry through the business on a self-supporting basis.

Credit is also due to the enterprising Calcutta firm which supplied the manure on a few months credit. If this help had not been given it would have been difficult, if not impossible, to distribute such a large quantity.

4. *Potato growing.*—During the year under report, depôts for the sale of seed potatoes were opened at 5 centres, *viz* :—

	Quantity of potatoes sold. Tons.
(1) Marbisu	2·20
(2) Lad Mawphlang	1·03
(3) Dumpep	1·14
(4) Jowai	·37
(5) Shillong	·44
Total ...	5·18

Demonstrations were carried out in fourteen centres in the districts. Three demonstrations were arranged in each of Shillong, Mawphlang and Umran circles and 5 in the Jowai subdivision, where this crop is not much cultivated. One maund of seed potatoes was planted at each centre with the following results :—

No.	Locality.	Name of cultivator.	Yield in lb. per 1 md. seed.
1	2	3	4
	(Summer crop, Jowai Circle.)		
1	Nongbah ...	U Rang ...	1,280
2	Mihmyntoloo ...	Jawain ...	1,010
3	Demthring ...	U Kat Lamong	640
4	Khlihtyrshi ...	U Elija ...	800
5	Mawpyut ...	U Iangiangti ...	The crop was destroyed by wild pigs.
	(Summer crop, Shillong Circle.)		
1	Mawlyngkneng ...	U Kumar ...	520
2	Umjajoa ...	U Soh ...	640
3	Cherra ...	Eljokisore ...	360
	(Summer crop, Mawphlang Circle.)		
1	Mawphu ...	Tharai ...	320
2	Mawnai ...	Bidor Singh ...	604
3	Jakum ...	Kison Singh ...	690
	(Winter crop, Umran Circle.)		
1	Nongpoh ...	Nogen ...	292
2	Ditto ...	Basir Ahmed ...	180
3	Lumpyngling ...	Hinmuney ...	Destroyed by cattle.

The results are promising, especially in the Bhoi country and Jowai subdivision, and the demonstrations are being continued in the present year.

Spraying with Bordeaux mixture.—During the year there was no demand for spraying the potato crop as the weather was very unfavourable for spraying operations, and the cost of material was exceptionally high.

Although considerable damage is done each year to the potato crop by potato blight, the cultivators do not yet fully appreciate the value of spraying as a preventive, and the practice is not adopted to any great extent.

5. *Ploughing demonstrations.*—Ploughing demonstrations were carried out in four centres at Mylliem, Umran, Barapani and Jowai by the Meston plough.

The cultivation done by one ploughing with this plough is as good as that done by 4 ploughings with the country plough. The results are encouraging and these demonstrations with the improved plough will be continued.

6. *Insect-pests.*—Rice pests, *viz.*, Rice fulgroid appeared in the district during the year. Remedial measures were taken by our staff and the ravages of these pests were successfully checked at six centres by the following means. The water in the affected field was covered with a film of kerosine oil, and the insects were then disturbed by drawing a rope or bamboo across the affected plants. When so disturbed these insects drop into the water and are quickly killed by the kerosine oil.

7. *Grafting and pruning of fruit trees.*—This work was continued as in the previous years, demonstrations being given by demonstrators from time to time on their tours. The following grafts were made in 24 villages :—

Oranges	Budded ...	242
Pears	„	169
Peaches	Grafted ...	144
Apples	„	50
Plums	„	83
Apricots	„	26
	Total ...	714

Up to the present no signs of disease have appeared on the oranges so budded.

The following plants are being prepared by grafting at the Wahjain Tropical Plantation :—

Jamica orange	3
Natal „	3
Litchis	3
Mangoes	6
Total	15

Pruning of fruit trees was done in 17 gardens including 11 in Shillong circle and 2 in each of Umran, Jowai and Garo Hills.

8. *Supply of seeds, plants, etc.*—The following seeds, plants, etc., were distributed during the year:—

Garo cotton seed	18	lbs.
Spanish chestnut	4	„
Orange seed	2	„
Soybean seed	4	„
Paddy seed (from Mawsiat Khnam)... ...	80	„
Maize (Nepali)	2	„
Arrowroot plants (from Mahadeo)	3	„
Coffee seed (ditto)	8½	„
Sohiong seed	2	„
Mulberry seed	4	Oz.
Custard apple	1	„
Papaya	1	„
Seed of pepper (round)	4	„
Seeds of squash	24	„
Cuttings of Shillong pear	200	number.
Cuttings of grape vines	12	„
Ditto black pepper	6	„
Ditto plums	10	„
Ditto figs	12	„
Ditto peaches	100	„
Orange seedlings	2,213	„
Lime	500	„
Bitter orange	12	„
Plums ordinary	70	„
Pear grafts	21	„
Pineapple suckers (from Wahjain)	4,500	„

The following tools were supplied during the year:—

Meston ploughs	2
Hand spraying pump	1
Secateurs	2
Khasi *kodalis* with sockets	3

9. *Pan disease.*—The Imperial Bacteriologist, Pusa, visited Shillong and Cherrapoonji last year and procured diseased specimens of plants for further investigations but no report has yet been received.

10. The following Botanical specimens were supplied during the year :—

Plants of kse—pharai (pitcher plant Nepenthes Khasiana).

Ditto Sohlang thrait (Ganeltheri Fragrantis Sima).

Ditto Kharlo (Pachycarpa).

Ditto and seeds of Sohramthein (Militia pulchra).

Ditto of yellow variety of cotton.

Seven pieces of Khasi cloth made of yellow of cotton.

11. *Demonstrations in the Garo Hills.*—During the year potato demonstrations with winter crop were laid down at four centres. One maund of seed was used in each centre, and this was planted on approximately $\frac{1}{10}$-th of an acre. The yield were as follows :—

Locality.	Yield from 80 lbs. of seed.	Remarks.
1	2	3
	lbs.	
Duragiri	328	
Rongkhongiri	400	
Amindagiri	160	
Harigao	Nil	Destroyed by insects.

The demonstrations were promising on suitable localities and the work is being continued in the present year.

12. Demonstrations with Garo cotton have been carried out in three centres in the Jaintia Hills and in one centre at Nongpoh. The seed was received very late and failed to germinate, fresh demonstrations are being made in four centres, *i.e.*, two in each of Jowai and Umran circles.

Demonstrations with local, well reputed paddy seed have been carried out at 5 centres in the Jowai subdivision, and the results obtained from 1 seer of seed used in each centre, are as follows :—

Jowai ...	... Nil.	The place is too high and the crop did not ripen.
Nongjuri ...	... 72 lbs.	
Shangpung ...	... 44 „	
Nartiang ...	... 52 „	
Nongbah ...	... 28 „	

The demonstrations were promising on suitable localities; 25 seers of the seed has been distributed free during the present year.

13. *New demonstrations.*—Demonstrations with yellow cotton are being made in 3 centres in Garo Hills.

Demonstrations with Khasi paddy seeds for hill and wet lands are being made in 6 centres in the Garo Hills.

Demonstrations with groundnut are being made in 2 centres in each of Shillong, Mawphlang, Umran and Jowai circles and in 4 centres in Garo Hills.

The services of the Demonstrator in charge of the Umran circle were dispensed with from October 1917.

CAMP KARIMGANJ :
The 8th August 1918.

J. W. McKAY,
Deputy Director of Agriculture,
Surma Valley and Hill Districts.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN THE SURMA VALLEY FOR THE YEAR ENDING THE 30TH JUNE 1918.

Staff.—The demonstration staff in the valley consists of one Superintendent, two Agricultural Inspectors and seven Agricultural Demonstrators, of which one was appointed in the last quarter of the year. We have now two Demonstrators in South Sylhet, one for each of the remaining subdivisions except Sunamganj, one for the Cachar plains, and one for the North Cachar Hills.

The Superintendent, Mr. L. Barthakur, was on tour for 241 days, Babu Binod Bihari Das, Agricultural Inspector, Sylhet, for 261 days and Mr. L. M. Das, Agricultural Inspector, Karimganj and Cachar for 175 days.

The number of touring days of the Agricultural Demonstrators varied from 105 to 241 days.

2. *Kinds of demonstrations.*—The main items of demonstration were as follows:—

(*a*) Paddy manurial tests,

(*b*) Trial with superior varieties of paddy,

(*c*) Introduction of improved sugarcanes and 3 roller mills and shallow *gur* boiling pans,

(*d*) Jute demonstrations—variety and manurial,

(*e*) Introduction of Shillong seed potatoes,

(*f*) Trials with new crops:

Jowar, for fodder, groundnuts, wheat, barley, oats, khesari, gram, mosoori, Assam mustard (large grained), linseed (large grained etc.),

(*g*) Demonstrations in the North Cachar Hills,

(*h*) Trials with Meston plough and Planet Junior Hoe;

(*i*) Miscellaneous: Conservation of cattle manure in covered pits, preparation of water hyacinth ash.

3. Paddy manurial demonstrations laid down in 1917 comprised the following kinds:—

(*a*) Bonemeal used alone,

(*b*) Bonemeal with crushed limestone,

(*c*) Oilcake alone,

(*d*) Oilcake with bonemeal,

(*e*) Green manuring with Dhaincha,

(*f*) Dhaincha with bonemeal,

(*g*) Dhaincha with crushed limestone.

Bonemeal was applied at the rate of 247 pounds (3 maunds) per acre, limestone at 823 pounds, oilcake at 494 pounds and *dhaincha* seed sown at the rate of 30 lbs. per acre. When conjointly used, bonemeal and oilcake were applied at half the above rates in Sylhet circle, while in Karimganj and Cachar circle they were used at full rates.

The average yield from each kind of manure and the costs are given in the following abstract:—

Kinds of manures.	Karimganj and Cachar.				Sylhet.				Average value of manured crop.	Average cost.
	Number of Demonstrations.	Average increase in outturn.	Value of the increased crop.	Cost of manuring.	Number of Demonstrations.	Average increase in outturn.	Value of the increased crop.	Cost of manuring.		
1	2	3	4	5	6	7	8	9	10	11
		Pounds.	Rs. a. p.	Rs. a. p.		Pounds.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Bonemeal	9	636	15 12 0	9 0 0	20	313	7 13 0	9 0 0	10 5 0	9 0 0
Bonemeal and limestone	1	701	17 8 0	18 0 0	...	...	...	18 0 0	...	...
Oilcake	2	76	1 14 0	12 0 0	6	329	8 3 0	12 0 0	6 6 0	12 0 0
Oilcake and Bonemeal ...	2	474	11 13 0	21 0 0	7	456	11 6 0	10 8 0	11 8 0	12 12 0
Dhaincha green manuring	9	468	11 11 0	1 12 0	8	150	3 12 0	1 12 0	9 11 0	1 12 0
Dhaincha and bonemeal ...	7	305	7 7 0	10 12 0	7	278	6 15 0	10 12 0	7 5 0	10 12 0
Dhaincha and lime ...	3	473	11 13 0	10 12 0	4	226	5 11 0	10 12 0	8 4 0	10 12 0

The above demonstrations were distributed over the following districts:—Duttagram, Tukerbazar, Lakshmipassa, Baraya, Jelalpur, Golapganj in North Sylhet, Shamshernagar, Srimangal and Kulaura in South Sylhet; Shaistaganj and Itakhola in Habiganj; Chotalekha, Shabazpur and Kayesthagram in Karimganj, Lakhipur, Banskandi, Lakhirband and Boalipar in Cachar.

4. The residual effects of bonemeal applied in 1915 and 1916, and that of dhaincha green manuring given in 1916, were observed by weighing the crops produced in 1917 from the plots so treated.

The results will be found in the abstract which is now given :—

Details of Demonstrations.	Average yield of manured plot in 1917-18.	Average yield of manured plot in 1917-18.	Increase in 1917-18.	Value of the increased crop in 1917-18 at Rs. 2 per maund.	Previous increases.	Value of previous increases at Rs. 3 per maund.	Value of the total increase.	Cost of manuring.
1	2	3	4	5	6	7	8	9
	Pounds per Acre.			Rs. a. p.	Pounds per Acre.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Average of 10 bonemeal demonstrations laid down in 1915 in Karimganj district.	2,075	1,727	348	8 11 0	874	21 8 0	30 3 0	9 0 0
Average of 12 bonemeal demonstrations laid down in 1916 in Karimganj district.	2,681	2,254	427	10 9 0	479	17 15 0	28 8 0	9 0 0
Average of 7 bonemeal demonstrations laid down in 1916 in Sylhet centres.	1,632	1,436	196	4 14 0	600	22 8 0	27 6 0	9 0 0
Average of 2 dhaincha green manuring demonstrations laid down in 1916 in Karimganj district.	2,770	2,774	496	12 6 0	535	20 0 0	32 6 0	1 12 0

The above demonstrations were distributed over the following districts :—

Barlekha, Patharia, Chotalekha in Karimganj and Tukerbazar, Ganganagar and Khojarkhola in North Sylhet.

Owing to the low price which prevailed for paddy this year none of the manurial demonstrations have given sufficient profit in one season to justify the expenditure incurred. It will, however, be seen from the results of these demonstrations, which have been kept under observation for several years, that the first year's increase is by no means the whole advantage to be gained from the use of these manures. Bonemeal or dhaincha green manure

used either separately or jointly are pretty sure to leave a substantial profit in three years, during which the effects of these manure are likely to be noticeable in the crops.

5. With a view to introduce superior varieties of paddy, a number of tests were carried out in various centres. George *sail* introduced by Srijut Narain Baruah of Nakachari, Honorary correspondent of the Department, and Indra *sail* and Kandulia introduced by the Bengal Department were tried against the best local varieties. The results are as follows:—

	George Sail	Country Sail.	Indra Sail.	Country Sail.	Kondolia Sail.	Country Sail.	Remarks.
1	2	3	4	5	6	7	8
	Yield in pounds per acre.						
Karimganj	2,003	1,038	1,841	2,293	2,304	2,306	
North Sylhet	...	...	1,555	1,457	1,078	915	
South Sylhet	...	...	2,409	2,213	1,298	1,170	
Cachar	2,706	1,705	2,028	...	1,608	...	

As indicated by the above figures these important varieties of paddy appear to behave differently under different soil and water conditions. Although on the average the improved varieties have given hopeful results, the yields are not sufficiently regular to justify a claim being made in favour of any particular variety, and therefore, with the object of throwing further light on the matter, a large number of fresh demonstrations are being organized for the present season.

6. *Sugarcane and sugar mills.*—Improved varieties of sugarcanes, *e.g.*, Striped Mauritius, B147, and B376, were introduced into this valley for the first time in 1916 from Upper Assam. In that year 9,000 sets were distributed. Last year 15,000 sets were brought from the Kamrup Farm. For this year's distribution a supply of 12,000 sets was secured from Jorhat and Kamrup and some 3,500 sets were obtained from local cultivators in return for sets supplied to them last year. Wherever introduced, these canes have established their superiority over the local canes, and the demand for sets is rapidly increasing. But for the high

freight rates from the Assam Valley, a much larger number could have been usefully distributed this year. Apart from the heavy cost of transit there is always a considerable risk of damage to sets in the long railway journey, and we, therefore, intend as far as possible to meet the increased demand in the future by means of local supplies of sets.

To effect this we are distributing sets in larger number to cultivators, who undertake to return to us in the following year a number of sets equal to that given.

Crushing demonstrations were given at various places near Shamshernagar, Bhanugach, Barlekha and Silchar. The results of these demonstrations show that the three-roller iron sugar mills gave, on the average, some 20 per cent. greater extraction of juice than was produced by the wooden mills. Wherever tried these mills have successfully proved their superiority to the ordinary mills. These mills could not be sold at less than Rs. 75 each, which is a very considerable amount for the cultivator to put down at one time, nevertheless four of the improved three-roller sugarcane mills and two shallow *gur* boiling pans have been sold during the year.

7. *Jute demonstrations.*—Kakaya Bombai jute of the Bengal Agricultural Departments was introduced into Sylhet in 1916 and since then it has been rising in popularity in the southern part of the valley. Variety and manurial tests were organized in 1917 and their results, which are tabulated below, speak for themselves:—

Centre.	Average number of demonstrations.	Kakiya Bombai Jute.	Country Jute.	Average number of demonstrations.	Yield of bonemeal.	Yield of no manure plots.
1	2	3	4	5	6	7
	Yield of fibre in pounds per acre.					
Itakhola (Surma)	8	1,564	1,305	3	1,293	1,109
Bejura	4	1,498	1,196	3	1,318	1,316
Shaistaganj	2	1,678	1,189	...	...	...
Ramnagar	2	2,121	1,408	...	...	...
Total ...	16	6,861	5,098	6	2,611	2,425
Average ...	...	1,600	1,276	...	1,305	1,212

Attempts to introduce Kakaya Bombai jute were made at other centres also, but, on account of the general fall in the price of jute last season, the advantage from growing the improved variety was not so apparent as in the abovementioned districts and little effect was produced in those places.

This year (1918) a number of variety tests and manurial demonstrations are being organized. For the purpose of popularising the improved jute seed a number of packets of Kakaya Bombai jute has been distributed throughout the district of Sylhet, and arrangements are being made for procuring a return of seeds equal to the quantity supplied.

8. *Introduction of Shillong potatoes for seed.*—During the year under report 120 maunds of Shillong seed potatoes was brought into the valley. Of this total quantity, 56 maunds were sold through Honorary correspondent, Babu Joy Nath Nandi of Bejura, 3 maunds supplied to Honorary correspondents, 52½ maunds distributed on demonstration account, and 6½ maunds lost through driage and rottage. In most of the places the demonstrations served the purpose of introduction only. Even those quantitative tests organized for testing the cropping power of Shillong seed potatoes against that of country and Bholaganj potatoes did not, owing to the general unfavourable character of the season, yield crops up to the average. Figures obtained from such demonstrations as were carried out under satisfactory conditions, go to show the superiority of the Shillong potatoes from every point of view. The following varieties were distributed, *viz.*, Magnum Bonum, King of Potatoes, Windsor Castle and Up-to-date. The cultivators appear to favour King of Potatoes and Windsor Castle owing to the fact that they are more waxy when cooked than the other varieties.

The average of 26 demonstrations carried out at Sylhet Shamshernagar, Srimangal, Shaistaganj and Bejura shows an outturn of 4,246 pounds (53 maunds) per acre from the Shillong seed and of 3,476 pounds (43 maunds) per acre from the country seed. Owing to the unfavourable season and the consequent small crop, the financial returns were poor from both kinds but the advantage was somewhat in favour of the Shillong seed.

9. *Trials with new crops.*—(*a*) *Jowar for fodder.*—Fodder Jowar was tried and successfully grown at several places in 1917. The crop grew some 5 feet to 8 feet high and in one plot it attained a height of 10 feet to 12 feet. As jowar does not grow well under water-logged conditions, cultivators are only encouraged to attempt to grow it on the higher lands, such as banks of tanks, sides of teelas, etc.

(*b*) *Groundnuts.*—Groundnuts have been successfully tried in several centres in Habiganj, North Sylhet and Karimganj. The cultivators are taking kindly to this crop and there seems to be hopeful prospects for its expansion. The outturn was some 26 maunds per acre equal to 10—12 times the quantity of seed used. This crop is readily saleable at remunerative prices.

(*c*) Wheat, barley and oats were tried at different centres with moderate success. Some good crops were obtained by up-country people at Gangapur in Silchar and at Teliapara in South Sylhet. Pusa wheat gave better results than local wheat.

(*d*) Khesari, Mosoori and gram also were tried, but the very dry cold season was unfavourable for these crops, and only slight yields were obtained.

(*e*) An attempt was made to introduce improved types of oil seeds—Assam mustard and a large-grained linseed from Calcutta were tried. The results are encouraging and the experiment will be repeated.

(*f*) Gandhi *sail*, a late variety of sail and Sachi amon a very deep water *amon* paddy, both from the Dacca district, were tried but with little success.

10. With a view to introduce new varieties and new crops into the North Cachar Hills, a number of tests in various centres were carried out with the following :—

Shillong potatoes, Khasi maize, Garo cotton, soybean, Jowar and groundnut. Fresh demonstrations with the above are being carried out in the present year also, and in addition, arrangements are being made for carrying out some wet paddy demonstrations, in districts where this crop has not been much cultivated previously. One hundred orange seedlings from Sylhet were supplied free to a Naga Mauzadar and 100 more were sold to a Nepalee cultivator near the Haflong station.

11. Meston plough demonstrations were given at Fenchuganj, Salutikar, Shamshernagar, Barlekha and several other places. Some of the cultivators appear to appreciate this improved plough especially for their cold weather crops.

The " Planet Junior hoe " was successfully tried near Shaistaganj for inter-cultivation for the potato crop.

12. *Covered manure pits.*—Cultivators are very slow to appreciate the utility of covered manure pits, and only a small number of pits has been prepared during the year under report.

13. *Water Hyacinth.*—Water Hyacinth introduced from the neighbouring districts of Bengal, is rapidly becoming a troublesome pests in the lower tracts of Habiganj and Sunamganj

With a view to acquaint the people with the economic and agricultural value of the ash of this pest, weeds were collected and ash prepared at Bejura, Chhatiain and Lakhai. A total quantity of 100 maunds was prepared under departmental supervision and a further quantity of 36 maunds was procured through cultivators. A portion of this stuff is being used for manurial trials, and a consignment of 70 maunds has been sent to Calcutta, in order to see whether or not it will be profitable for local people to undertake the preparation and sale of Hyacinth ash as a manure.

The experiment station of the Tea Association at Cinnamara and a few tea planters have kindly undertaken to test the manure during the present year. If the material can be prepared at a reasonable price it is possible that there may be a local demand for it as a tea manure.

J. W. McKAY,

Deputy Director of Agriculture,
Surma Valley and Hill Districts.

SHILLONG,
The 26th July 1918.

GLOSSARY.

Kharif	The rainy season.
Rabi	The cold season.
Ratoon	The second year's sugarcane crop grown from plants put down in the previous year.
Aus	Autum rice.
Sail	Winter rice.
Asra	A shorts stemmed variety of deep water winter rice.
Dhaincha	Sesbania aculeata.
Cowpea	Vigna catiang.
Jowar	Andropogon sorghum var. vulgare.
Kalai	Phaseolus mung var. radiatus.
Khesari	Lathyrus sativus.
Musur	Lens esculenta.
Mung	Phaseolus mungo.
Gram	Cicer arietinum.
Coriander	Coriandum sativum.
Radish	Raphanus sativus.
Rape	Brassica Campestris.
Matikalai	Phoseolus mungo var.
Kulthikalai	Dolichos biflores.
Lucerne	Medicago sativa.
Wheat	Triticum vulgare.
Oats	Avena Sativa.
Sugarcane	Sacharum officinarum.
Beer seem	Trifolium alexandrium.
Soy beans	Clycine hispida.
Paddy	Oriza sativa.
Indigo	Indigofera tinctoria.
Groundnuts	Arachis hypogæa.
Sunn Hemp	Crotalaria juncea.
Job's tears	Coir lachryma.
Raishan	Paspalum sanguinale.
Maund	82⅔ ponnds.
Jhum	A system of cultivation consisting of paving and burning the surface.

REPORT

OF THE

AGRICULTURAL EXPERIMENTS AND DEMONSTRATIONS

IN

ASSAM

FOR

NINE MONTHS ENDING THE 31ST MARCH 1919.

SHILLONG:
PRINTED AT THE ASSAM SECRETARIAT PRINTING OFFICE.

1919.

REPORT OF THE UPPER SHILLONG EXPERIMENT STATION FOR NINE MONTHS ENDING 31ST MARCH 1919.

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Report of the Jorhat Agricultural Experiment Station for nine months ending the 31st March 1919.

1. *Introduction.*—This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most *rabi* crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented with in culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture in India, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag, for instance, rather than in the form of acid superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years in our own experience is clearly detrimental in the absence of periodic lime dressings on sour soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about 35½ acres, of which 1·7 acres is *hola* or ravine land and the remainder high land, which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 1 acres is *hola* land and the remainder high land.

The total area at present is thus 59½ acres. Most of the newly-added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. *Soil.*—The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth.

The following report is by Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

Report on analysis of Jorhat Farm soil.

	Surface soil.	Sub-soil.
	Laboratory No. 5.	Laboratory No. 5(*a*).
1	2	3
A	Per cent.	Per cent.
Soluble in Hydrocloric acid with 12 hours' digestion at 100°C.		
Phosphoric acid (P_2O_5)	0·025	0·020
Potash (K_2O)	0·115	0·135
Lime (CaO)	0·154	0·144
Magnesia (MgO)	0·166	0·148
B		
Soluble in one per cent. citric acid with 7 days' digestion.		
Phospheric acid	0·008	0·008
Potash	0·007	0·011
C		
Loss on ignition (organic matter and combined water)	3·26	1·84
Nitrogen	0·115	0·051
Calcium carbonate	0·018	0·018
Reaction	Acid	Acid.

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime, is quite deficient in quantity.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

A good deal of the organic matter present is of a double character and consists very probably of very old residues of little value; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one, but in view of the absence in anything like adequate quantity of carbonate of lime, conditions for nitrification and soil bio-chemical processes generally are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in "total" as well as "available" supplies. There is thus a "real" as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus, high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself, very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crop will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that the green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures. No amount or combination of the latter can ever make up, in the case of a crop like sugarcane, for loss of fertility due to shallow cultivation and lack of " humus ".

3. *Buildings, machinery, etc.*—The farm is equipped with a godown, combined office and rest house, Farm Manager's bungalow, clerks' and apprentices' quarters, cattle shed, Dutch barn, and is enclosed by " Ideal " wire fencing.

A Hornsby oil engine and crushing mill capable of dealing with 1 ton cane per hour was installed in 1911 and has given every satisfaction since.

The only new construction work carried out during the year was the erection of a cattle manure shed with wooden posts, thatched roof and mud walls at a cost of Rs. 120, and two additional coolie huts costing Rs. 85 altogether.

The new manure shed is entirely above ground. Previously manure was stored in pits covered by a shed, but this practice has been discontinued owing to the difficulty of preventing subsoil water from flooding the pits.

4. *Rainfall.*—The rainfall recorded during the year under report is given below together with the normal rainfall :—

Month.	Actual (inches).	Normal (inches.)
1918 April	4·90	8·54
„ May	12·11	9·26
„ June	17·25	11·36
„ July	19·62	14·76
„ August	18·75	15·15
„ September	12·03	9·18
„ October	2·89	4·07
„ November... ...	Nil	0·69
„ December	0·28	0·52
1919 January	0·15	0·93
„ February	0·99	1·32
„ March	0·72	3·90
Total ...	89·70	79·68

The rainfall was in defect up till June, but from then on till September was in excess and the temperature was lower than usual; in fact it was not "good growing weather" for cane. From the middle of October until the end of the year under report the weather was exceptionally dry, the total rainfall for this long period only amounting to just over two inches.

5. *Experimental work.*—The work of previous years was continued and extended as follows :—

I. Sugarcane experiments, including varietal, manurial planting and testing of new varieties.

II. Soil investigations and manurial experiments.

III. Trials of pulse crops.

IV. Trials of fodder crops.

6. *Sugarcane.*—This work includes the testing of varieties under chemical control, manurial experiments in the cane rotation, trials of various methods of planting, and the distribution of the best varieties to selected cultivators. This year 64,000 setts were distributed from the farm.

Generally speaking the season was not very favourable for cane. The early months were hot and dry followed by a wetter and colder rainy season than usual. The cold weather was abnormally dry.

In last year's report mention is made of a fungus disease *Melanconium Sacchari* which did serious damage to the 1917-18 crop. This disease was found to attack as a rule only canes injured by "borer" or by "lodging." This year a vigorous campaign against borers was carried on throughout the season with the result that the amount of cane damaged by this pest was very much less than usual, and in consequence the fungus disease was kept in check and did very little harm to the crop.

7. *Sugarcane varieties. Ratoon cane.*—The following varieties planted in Block D in February 1917 were ratooned :—B147, Striped Mauritius, B376, Barbadoes A and B-6450 on both phosphated and non-phosphated areas, B3412, J33a and Barbadoes B on the phosphate area only and Magh and Magh Sport, on the non-phosphate area only. The results of the plant can crop were given in paragraph 8 of last year's report.

As in previous years the trosh from the plant cane was burnt on the field, and the young ratoons were given frequent intercultivation and two earthings. The crop received 2,400 lbs. rape cake per acre applied in two equal dressings at the times of earthing.

The crop was harvested in February 1919. The results are set out in Table I.

Striped Mauritius gave the biggest crop and the largest outturn of sugar. B-376 was a little below its average in yield probably owing to the severe attack of *Melanconium Sacchari* on the plant cane last year. B-147 was even worse than last year as a ratooner ; this variety undoubtedly appears to be losing its vitality. The following figures compare this year's crop with the average of the previous five years :—

Variety.	Lbs. of cane per acre.	
	Season 1918-19.	Average of previous 5 years.
B-147 ratoon ...	30,142	49,792
Striped Mauritius ratoon	66,082	61,368
B-376 ratoon ...	48,915	53,408

It is evident from this that Striped Mauritius is more than maintaining its position as to the best ratooning variety, while B-147 has fallen off seriously in this respect.

Of the newer varieties Barbadoes A, B-3412 and J-33a gave big crops. Their sucrose content is, however, low and they are all characterised by an undesirably high glucose ratio and a low co-efficient of purity of juice. The best of the three is J-33a which, expect for its hardness, would appear to be a promising cane from the cultivator's point of view, as it stands up to adverse conditions very well.

Another new variety, *viz.*, B-6450, while not cropping heavily, gave a very rich and pure juice.

The local varieties Magh and its sport compare very unfavourably with all the introduced varieties, as will be seen from the figures.

Phosphate area.—As was the case in the plant cane on this Block last year, so again this year the phosphate plots showed a slight decrease in weight of canes fit for milling as compared with the non-phosphate plots. The decrease this year amounted to an average of 2·1 tons per acre. The phosphate area suffered very badly last year from the disease *Melanconium Sacchari* and the decrease in the ratoons this year is probably to be explained by this.

TABLE I.

Block D. Ratoon cane 1918-19. *Varieties.*

(Figures are per acre.)

Variety.	Plot No.	Plot area.	Cane (lbs. per acre.	Juice (lbs. per acre).	Expression; juice on cane).	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.		Per cent.	Lbs.	
B—147	1	1/10th ...	30,740	18,220	59·2	16·30	0·76	4·68	90·0	2,970	The (a) plots were on the phosphated area.
	1a	,, ...	29,545	16,135	55·9	16·14	0·76	4·74	91·1	2,669	
Striped Mauritius	2	,, ...	70,890	42,720	60·2	16·91	0·70	4·14	91·2	7,224	A great deal of damage was caused by rats in certain plots notably in Nos. 2a and 3a and to a less extent in No. 3. The cane in these plots was lodged very badly by storms thus providing good cover for the rats. Varieties which did not lodge were very little damaged.
	2a	,, ...	61,275	40,450	66·0	15·88	0·81	5·12	90·3	6,424	
B—378	3	,, ...	50,260	31,935	63·5	15·00	0·90	6·02	89·4	4,790	
	3a	,, ...	47,580	30,616	64·3	14·34	1·05	7·34	88·4	4,390	
Barbadoes A	4	,, ...	66,350	42,230	63·6	12·45	1·95	15·70	81·2	5,260	
	4a	,, ...	63,240	38,275	60·5	11·70	2·07	17·74	78·9	4,478	
B—6450	5	,, ...	46,910	31,065	66·2	17·24	0·67	3·89	90·1	5,356	
	5a	,, ...	39,455	25,590	64·8	16·49	0·78	4·77	90·4	4,220	
B—3412	6a	,, ...	69,030	43,610	63·1	12·37	1·88	15·24	81·8	5,395	
J—33a	8a	,, ...	74,840	44,720	59·7	13·74	1·87	13·62	81·5	6,145	
Barbadoes B	9a	,, ...	40,780	26,065	63·9	13·74	1·61	11·77	84·4	3,581	
Magh	6	,, ...	17,245	10,582	61·3	15·29	0·93	6·09	85·1	1,618	
Magh Sport	7	,, ...	21,215	11,795	55·5	15·51	0·99	6·35	87·2	1,830	

8. *Sugarcane varieties—Plant cane—Block E.*—Following the usual rotation this block was given in 1917 a dressing of ground limestone at the rate of 1,600 lbs. per acre over the whole area, and 560 lbs. of Flour Phosphate on the one acre which received a similar dressing in 1913. The cropping in 1917 was Cowpeas ploughed in for green manure followed in the autumn by a crop of rape which was also ploughed in. The land was then fallowed until March 1918 when the cane was planted. Both Cowpeas and rape made much bigger crops on the area which received phosphate in addition to limestone.

The following ten varieties were planted in duplicate plots on both phosphate and non-phosphate areas—B-147, Striped Mauritius, B-376, Barbadoes A, B-6450, B-3412, Magh Sport, J-33a, Barbadoes B, and Magh. White Mauritius, a local Sport of Striped Mauritius, occupied a plot on the non-phosphate area only. The area of each plot on the non-phosphate area was $\frac{1}{20}$ acre and on the phosphate area $\frac{1}{30}$ acre.

All plots were given the same cultivation and manuring, which consisted of 20,000 lbs. cowdung per acre at planting time, 10,000 lbs. cowdung at the first time of earthing and 560 lbs. groundnut cake (N. equiv. 10,000 lbs. cowdung) at the second time of earthing.

The results are shown in Tables II and III.

The season was not so favourable as in the previous year and the average crop over the whole area is somewhat less in consequence, being 27·5 tons stripped cane per acre, as against 33·4 tons per acre last year. It is satisfactory evidence, however, of the soundness of the rotation that, four years ago when this block was last under plant cane, the average crop was only 22·5 tons per acre.

The older varieties Striped Mauritius and B-376 again yielded very heavy crops, but B-147 was much below its average.

Of the newer varieties Barbadoes A, B-3412 and J-33a again gave high yields, but, with the exception of J-33a, their sucrose content and purity were disappointing. They, however, ripened off their juice much better than last year, and some of them may yet acclimatise to our conditions. B-6450, while showing a high sucrose content and purity, did not produce a heavy crop. White Mauritius, a Sport which we have separated from Striped Mauritius, did very well yielding a heavy crop of high quality cane.

The highest yield of sucrose per acre in expressed juice was again returned by Striped Mauritius on plot 2a with over 9,800

lbs. sucrose per acre, followed by B-376 plot 3a with over 9,600 lbs.

Phosphate area.—The average increase in crop for all the ten varieties due to mineral phosphate amounts to 6,565 lbs. stripped cane per acre. Although this is within the limits of experimental error, the fact that four years ago when this area last carried cane, the average crop on the phosphate area was less by some 4,000 lbs. per acre than on the non-phosphate area, while this year the reverse is the case, is satisfactory evidence that, with lapse of time, raw mineral phosphate is coming into use. Moreover, the average yield on the phosphate area this year is some 12,000 lbs. per acre in excess of the yield on the same area in season 1914-15.

TABLE II.

Block E. Plant cane 1918-19. *Varieties. (Non-phosphated area).*

(Figures are per acre).

Variety.	Plot No.	Plot area.	Cane (lbs. per acre).	Juice (lbs. per acre).	Expression; juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.		Per cent.	Lbs.	
B-147	1	2/3 ...	40,440	26,804	66·2	17·94	0·59	3·30	92·3	4,809	
	11	,, ...	40,400	25,040	64·1	17·39	0·53	2·05	92·5	4,667	
Striped Mauritius ...	2	,, ...	66,920	45,480	67·9	18·20	0·43	2·39	94·8	8,277	
	12	,, ...	58,640	37,504	63·9	17·97	...	...	94·5	6,740	
B-376	3	,, ...	82,000	54,700	66·6	17·24	0·50	2·91	93·7	9,430	
	13	,, ...	71,960	44,200	61·4	17·56	0·48	2·72	95·1	7,760	
Barbadoes A	4	,, ...	62,880	42,080	66·9	13·94	1·66	11·94	83·8	5,866	
	14	,, ...	72,520	46,864	64·6	14·58	1·61	11·04	84·5	6,833	
B-6450	5	,, ...	41,760	27,140	65·0	18·31	0·36	1·93	93·6	5,105	
	15	,, ...	38,140	24,350	63·8	18·87	0·44	2·36	93·7	4,595	

B-3412	6	,,	72,260	46,830	64·7	15·00	1·43	9·54	87·1	7,025
	16	,,	76,420	51,024	66·5	14·90	1·43	9·60	87·3	7,603
Magh Sport	7	,,	44,480	27,380	61·5	15·51	1·22	7·88	86·5	4,247
	17	,,	64,180	39,400	61·7	15·27	1·47	9·62	86·8	6,016
J-33a	8	,,	64,260	38,370	59·5	16·41	0·95	5·78	90·4	6,280
	18	,,	66,260	38,480	58·0	16·40	0·91	5·55	89·3	6,334
Barbadoes B	9	,,	53,200	33,840	63·6	14·47	1·51	10·47	85·3	4,897
	19	,,	57,560	36,800	63·9	15·00	1·39	9·26	86·5	5,520
Magh	10	,,	44,040	27,700	62·0	15·00	0·89	5·92	87·6	4,155
	20	,,	46,660	used for planting		...	...	...	...	...
White Mauritius	21	,,	76,800	47,370	61·6	13·60	0·57	3·06	93·7	8,839

TABLE III.

Block E. Plant cane 1918-19. *Varieties.* (*Phosphated area*).

Figures are per acre.

Variety.	Plot No.	Plot area.	Cane (lbs. per acre).	Juice (lbs. per acre.)	Expression; juice on cane.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity co-efficient of juice.	Sucrose per acre in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.			Per cent.	Per cent.	Per cent.		Per cent.	Lbs.	
B—147	1a	⅒	40,560	26,670	65·7	17·20	0·76	4·43	90·8	4,587	
	11a	,,	40,500	26,010	64·3	...	...	...	...	...	
Striped Mauratius	2a	,,	84,570	54,330	64·2	18·07	0·47	2·64	93·6	9,817	
	12a	,,	78,060	48,480	62·1	...	...	...	...	...	
B—376	3a	,,	87,540	56,580	64·5	17·00	0·64	3·76	92·3	9,618	
	13a	,,	69,210	45,090	65·1	...	...	...	...	..	
Barbadoes A	4a	,,	73,710	48,360	65·5	...	...	...	...	...	
	14a	,,	82,170	54,870	66·7	...	...	...	...	...	

B -6450	5a ...	,, ...	40,500	26,190	64·6	...	...	...	...	...
	15a ...	,, ...	43,740	28,650	65·5	...	...	...	...	...
B—3412	6a ...	,, ...	95,340	62,220	65·2	...	...	...	...	...
	16a ...	,, ...	80,160	49,260	61·4	...	...	...	...	...
Magh Sport	7a ...	,, ...	49,140	30,900	62·8	...	...	...	...	...
	17a ...	,, ...	55,260	33,420	60·5	...	...	...	...	...
J —33a	8a ...	,, ...	78,060	45,570	58·3	...	...	...	...	...
	18a ...	,, ...	65,340	38,220	58·4	...	...	...	...	...
Barbadoes B	9a ...	,, ...	78,090	50,700	65·0	...	...	...	...	...
	19a ...	,, ...	57,720	35,520	61·5	...	...	...	...	...
Magh	10a ...	,, ...	57,240	38,250	66·8	...	...	...	...	...
	20a ...	,, ...	33,960	21,400	63·3	...	...	...	...	...

9. *Sugarcane planting experiment—Ratoon cane*.—The plant cane results of this experiment appear in paragraph 9 of last year's report. The experiment provides for testing the value of wide and narrow trenches on the Java model, and also the different disposition of the setts in both cases. All trenches were 9 inches deep and 5 feet from centre to centre. In plots 1 to 4 they were 2 feet wide while in plots 5 and 6 they were only 1 foot wide. Eight thousand setts per acre were planted on all the plots. Cultivation and manuring was similar to that of the ratoons in the variety experiment. Other details are shown in Table IV together with the results.

As was the case with the plant cane last year the results are very close. Taking the two years together, however, while there would appear to be little or no advantage in having the trenches more than 1 foot wide, there thus seem to be some justification for planting the setts in a single row up the centre of the trenches rather than in two parallel rows. The difficulty of earthing the canes properly in the latter case probably accounts for this.

TABLE IV.

Block D. Ratoon cane 1918-19. *Planting experiment.*

(Figures are per acre.)

Variety.	Plot No.	Method of planting.	Plot area.	Cane (lbs. per acre.)	Juice (lbs. per acre.)	Expression, juice on cane.	Remarks.
1	2	3	4	5	6	7	8
			Acres.	Lbs.	Lbs.	Per cent.	
Striped Mauritius.	1	Java trenches 2 feet wide and 9 inches deep, 5 feet from centre to centre, setts 8,000 per acre planted in a single row up centre of trenches.	1/6 ...	62,160	38,635	62·1	
	2	Java trenches as in plot 1, but setts 8,000 per acre were disposed in the bottom of the trench in two parallel rows 12 inches apart.	1/6 ...	56,800	36,645	64·5	
	3	Duplicate of plot 1 ...	1/6 ...	62,780	40,015	63·7	
	4	Duplicate of plot 2 ...	1/6 ...	54,340	35,157	64·6	
	5	Java trenches 1 foot wide and 9 inches deep, 5 feet from centre to centre. Setts 8,000 per acre disposed in double parallel rows 6 inches apart.	1/6 ...	57,160	35,992	63·0	
	6	Java trenches as in plot 5, but setts disposed in a single row.	1/6 ...	52,000	32,955	63·3	

10. *New varieties of cane.*—As mentioned in paragraph 10 of last year's report a number of varieties were introduced early in 1918. These include three of Dr. Barber's seedling canes Co. 1, 6 and 9; three Java varieties J-36, 139 and 213; Ashy Mauritius, Mauritius 55, 90 and 131; D74; a purple Sport of Striped Mauritius from Kamrup; five varieties introduced into the Kamrup Farm by Mr. Maxwell; White and Red Bombai; Manjav from Manjri Farm, Poona; and seven varieties from the Surma Valley.

These were specially grown in the nursery in 1918, and several show much promise—notably Purple Mauritius, D74 and Co. 6 and 9.

Most of the above varieties are being grown on a field scale this year for observation and with a view to introduction in the variety experiment trials in 1920.

In March 1919 five additional new Java varieties were received direct from the Passoeroen Sugar Experiment station, Java, and have been planted in the nursery.

11. *Soil investigations and manurial tests.*—The various experiments bearing on this work, most o which have reference to the treatment of sour soils, were continued. Now that the laboratory is completed and chemical work on the soil is possible it is hoped to modify and perhaps extend this work and place it on a better footing.

The work includes:—

Block G—Liming experiment commenced in 1909.

„ C—Liming and manurial experiment; also an experiment in the use of wood ashes, commenced 1911.

„ K—Experiments to ascertain the reasons underlying the beneficial effect of lime on the old red alluvium, and to test the action of various manures with and without lime, commenced 1912.

„ L—Ground limestone experiment, commenced 1913.

Blocks E, B, A & D—Experiments in the use of raw mineral phosphate in the sugarcane rotation initiated 1913, 1914, 1915 and 1916, respectively.

For previous details the reports for 1912 to 1918 may be consulted.

12. *Block G. Liming experiment.*—Half of this block was limed 10 years ago, and both sides have been regularly and similarly cropped since to see how long the effect of the single dressing of

lime will last. The cropping this year was cowpeas for green manure in the rains followed by matikalai, oats, gram and rape in the cold weather.

The cowpeas made a fair crop on the limed area, but a very poor one on the other.

The cold weather crops germinated well all over, but died off very early on the unlimed area. On the limed area the gram and rape died off later, while the oats and matikalai, although carrying through, produced practically no grain.

The effect of the lime clearly persists, but is gradually diminishing.

13. *Block C, Lime and Manurial Experiment.*—This experiment, designed to last in the first instance for 6 years, finished its initial course in 1917. By that time each of the limed sections had received a total of 2 tons of slaked lime per acre either (*a*) as one initial application, or (*b*) as two equal triennial dressings, or (*c*) in six equal annual dressings.

As regards cross dressings, each of the phosphate plots had a total of 1,440 lbs. bonemeal, *i.e.*, 240 lbs. annually, for 6 years. Each of the cowdung plots had been given a total of 48,000 lbs. cowdung, *i.e.*, 8,000 lbs. per annum for the 6 years.

It was considered desirable to continue this experiment for residual effect. In deciding on the lines of continuance it was considered that we should distinguish between—

(A) manures used as soil treatment, *i.e.*, those used with a view more or less permanently to improve the soil for all cropping rather than supplying the immediate requirements of any particular crop. In this category we placed lime and bonemeal in view of the probability that the amount of either applied in the previous 6 years may be expected to influence cropping for some years to come, and also it is desirable to measure the residual effect of these two manures; and

(B) other manures, *e.g.*, cowdung, which are more transient or whose effect on the soil is not of such a permanent character. In a hot and humid climate such as ours, green-manures would also have to be placed in this category we think.

It was therefore decided—

(*a*) to apply no more lime or bonemeal for the present;

(*b*) to continue green-manuring one block once every four years;

(*c*) to continue the annual cross-dressing of cowdung on sub-plots C and D.

The following rotation commencing from 1918 was decided on :—

—	Plots 1 to 4.		Plots 5 to 8.	
1	2		3	
	Kharif.	*Rabi.*	*Kharif.*	*Rabi.*
1st year (1918)...	Soybeans		Soybeans.	
2nd „ (1919)...	Jowar	Matikalai or Mustard.	Jowar	Matikalai or Mustard.
3rd „ (1920)...	Soybeans		Soybeans.	
4th „ (1921)...	Jowar	Oats	Cowpea for green manure	Oats.

Accordingly all plots were sown with soybeans in 1918, 100 maunds of cowdung per acre having been previously applied to sections C and D.

Germination was good, the crop came away well and continued to do normally up to the end of September, but the heavy and continuous rain of August and September adversely affected it and thereafter all plots gradually became diseased. *Rhizactoina* appearing in patches everywhere and gradually spreading The more heavily manured plots were the first to go down with the disease. The crop had flowered and fruited all over the block, but subsequently it wilted and died out, so on the advice of the Imperial Mycologist, Pusa, it was burnt off. Therefore no cropping figures are available this year.

Some observations made previous to the attack are, however, interesting. (For plan of experiment see last year's report Table IV, page 18).

Lime dressing.

(*a*) *Non-green manured block.*—Plot 3 (triennial dressings) was best throughout followed closely by plot 2 (annual dressings) and then plot 4 (one initial large application). The non-limed area (plot 1) was carrying a yellowish looking stunted crop throughout.

(*b*) *Green manured block.*—Plot 6 (annual dressings) was best throughout, followed in order of merit by plot 7 (triennial dressings), plot 8 (one initial large application) and plot 5 (no lime).

The evidence such as it is, therefore, was again in favour of the lighter and more frequent dressings as against the large initial one in this, the 8th year of the experiment.

Cross dressings.—The cowdung showed up very strongly on this crop, and where applied (sections C and D) seemed largely to mask the effect of the phosphate, and also the lime dressings to a less extent. On sections A and B, however, which received no cowdung, there was a marked contrast between the lime and the non-limed plots, but in plots 2, 3, 4, 6, 7 and 8 the lime appeared to mask the action of the phosphate, the section cross dressed with bonemeal being little better than the corresponding section which received no cross dressing.

In plots 1 and 5, however, which received no lime, the section cross dressed with bonemeal was very much better than the section which received no cross dressing, and the section which was treated with bonemeal *plus* cowdung was a little better than that which received cowdung alone. Judging from this it appears that the bonemeal is still taking effect, but so far as this crop is concerned its action is very much less than that of lime and cowdung.

14. *Wood ashes experiment.*—In this experiment five plots received respectively 5, 10, nil, 15 and 20 maunds of wood ashes per acre per annum. Half of each plot is cross dressed annually with 100 maunds of cowdung per acre.

This is essentially a cultivator's experiment, and shows what can be done towards soil improvement on the old alluvium with wood ashes, especially if supplemented by cowdung.

From 1918 the same rotation as for Block C was adopted and Soybeans were sown, half of each plot receiving its annual dressing of cowdung before sowing. The crop suffered the same fate as that on Block C. Up to the time of the *Rhizactonia* attack the crop increased with increasing doses of ashes, the cowdung sections of the plots being better in each case.

15. *Block L. Ground limestone experiments.*—This was commenced in 1913 on very infertile newly broken up land. The scheme consists of 6 plots, each ⅓ acre in area, in two series of 3 plots each. The first series, Section A, is cultivated shallow with country implements; while the other series, Section B, is being worked deeper with English implements. This ensures a deeper application of the limestone on section B than on section A, one of the chief objects of the experiment being to elucidate the effects of incorporating lime with the soil to varying depths, using a variety of cropping.

Ground limestone was applied as follows in 1913:—

Sections A and B { Plot 1—15 maunds limestone per acre.
„ 2—Nil.
„ 3—30 maunds limestone per acre.

Further details of the scheme are given in previous years reports.

The cropping this year, the sixth of the experiment, was Dhaincha for green manured followed by oats. A dressing of 150 maunds per acre cowdung was applied previous to sowing the oats. The Dhaincha was sown very late owing to the previous Rahar crop being late in ripening, and consequently did not do really well on any plot.

Notes made on the appearance of the crop before ploughing in :—

Section A—Plot 3—Best crop, about 8 annas.
„ B— „ 3—Second best, about 5 to 6 annas.
„ A— „ 1—Third best, about 4 annas.
„ B— „ 1—Fourth best, very poor 2 annas.

Plots 2A and 2B (no lime) carried no crop at all.

The Dhaincha was ploughed in early in August 1918. The oats germinated well on all plots. The yields per acre (grain) were :—

—	Plot 1.	Plot 2.	Plot 3.
1	2	3	4
	lbs.		lbs.
Section A (shallow)	388	nil	708
„ B (deep)	290	nil	750

Most of the seedlings died off early on the non-limed plots.

The results are difficult to explain in view of the fact that in previous years, with oats as the crop, section A has always done better than section B. This year section A leads only on plot 1, the increase here being probably outside the limits of experimental error, while section B plot 3 is better by 42 lbs. than section A plot 3, which is well within the limits of experimental error. However, these apparently conflicting results may have some significance. The full explanation will possibly be apparent only when the soils have been examined in the laboratory, but it is probable that in an abnormally dry season such as last cold weather, deeper cultivation would show more effect than in a normal season, and its greatest effect where other soil conditions were least objectionable. With a gradual return to acidity better conditions would be more likely to be met with on plot 3 than on plot 1, and the lime requirement of the surface soil of plot 1B is probably so much greater now than that of

plot 3B, that it masks every other influence. A factor, then, which might operate favourably in the case of plot 3B might be put quite out of court by the extra acidity in plot 1B. There is also other proof, from Block K, with increasing acidity, other factors become less and less operative for good, and this will probably prove to be the true explanation of this year's results.

16. *Block K. Experiment to ascertain the early functions of Lime.*—Commenced in 1912, this experiment was continued in its seventh year. For previous results reference may be made to Jorhat Farm reports for 1913 to 1918 and to Memoir No. 9, Volume III, Chemical Series of the Memoirs of the Department of Agriculture in India, entitled "Studies of an acid soil in Assam." The experiment is being carried on with a view to throwing further light on some aspects of the use of certain manures, both with and without lime on sour soils.

With lapse of time these plots are becoming increasingly instructive. Cropping was Cowpeas for green manure followed by oats. The results for the cowpea crop are of interest in regard to the continued use of certain artificials on green crops on this class of soil. Thus by far the smallest crop in the area was that of plot 11 which annually receives a dressing of sulphate of ammonia, which yielded only $\frac{1}{8}$th of the outturn of the non-manure plot. Taking the yield of this sulphate of ammonia plot to be 100, the relative yields of some other plots were as follows :—

Plot No.	Manuring.	Relative yields of cowpea crop.	
		Without lime.	With lime.
11	Sulphate of Ammonia	100	1,355
20	Nitrogen as Nitrate of Soda	...	...
	Superphosphate	...	...
	Sulphate of Potash	1,810	2,176
21	Nitrogen as Sulphate of Ammonia ...	...	...
	Superphosphate	...	...
	Sulphate of Potash	500	1,788
22	Nitrogen as Nitrate of Soda	...	...
	Superphosphate	1,100	1,853
23	Nitrogen as Sulphate of Ammonia ...	...	...
	Superphosphate	290	1,001
24	Nitrogen as Nitrate of Soda	...	...
	Sulphate of Potash	890	1,088
25	Nitrogen as Sulphate of Ammonia ...	...	...
	Sulphate of Potash	100	1,088

Without any desire to lay stress on these figures, the plots being small, it will be clear, I think that the use of Sulphate of Ammonia as a source of Nitrogen reduces the yield of the green crop as compared with the use of the same amount of Nitrogen as Nitrate of Soda; this applies even when lime is used, but more strikingly in the absence of lime. This deliterious effect is less marked where Superphosphate is applied along with the Sulphate of Ammonia. The figures would indicate also that, in the absence of lime, Sulphate of Potash and Superphosphate are less effective in manurial mixtures when the source of Nitrogen is Sulphate of Ammonia rather than Nitrate of Soda.

The results obtained in this experiment year after year do certainly emphasise the great value of lime and phosphoric acid (more particularly in its basic forms) on this soil, and the markedly deliterious effect of Sulphate of Ammonia without lime in some form. The Sulphate of Ammonia plot is now almost, if not quite, sterile even to weeds.

17. *Blocks E, B, A, and D. Mineral phosphate experiments in the sugarcane rotation.*—An area of about 1 acre in each of the four blocks in the cane rotation, has been dressed with flour phosphate with a view to observing its effect on the various crops of the rotation. The phosphate is applied in the 4th year of the rotation previous to sowing the green-crop of cowpeas. It will be repeated every fourth year at the same point in the rotation. The rotation is as follows :—Cane in the 1st and 2nd years; a green-crop of dhaincha followed by oats in the 3rd year; a green-crop of cowpeas followed by a catch crop of rape ploughed in in the fourth year.

It will naturally be some years before very much information will be available; at least we should work through two and preferably three complete rotations on each block before attempting to generalise.

The first rotation has now been completed on Blocks E, B and A. The results for E and B appeared in previous reports.

On Block A during the first and second years of the rotation there was an average increase in favour of the phosphate plot for the two crops of cane of 4½ tons stripped cane per acre valued at Rs. 45.

In the third year of the rotation the yield of oats was almost identical on the phosphated and non-phosphated areas.

The total value of the increase is thus Rs. 45 per acre at a cost for phosphate of Rs. 15-12 leaving a net profit for the first four years of Rs. 29-4 per acre.

In paragraphs 7 and 8 of this report will be found an account of the effect of the phosphate on the ratoon and plant cane crops of the year under report.

Block B was the area to get phosphate this year; this is its second application, the first having been given in 1914. The following cowpea crop (rains 1918) did well all over; it was not weighed and it is difficult to judge differences in the field. The rape crop (*rabi* 1918-19) made a twelve-anna crop on the phosphated area, and 4 annas on the other. The rape was ploughed in in November 1918.

18. *Pulse crops.*—A number of pulse crops were sown on small plots with the object of testing their suitability for cultivation as food crops on similar land in the valley. Duplicate sowings were made, the first in September and the other in October. Sowing was done in lines two feet apart. The vegetative growth of the earlier sowings was much greater than that of the later sowings. In the results from 8 varieties sown, the earlier sowings did best in five cases, while the later sowings gave the better results in three. It is probable that still earlier sowing would give better results in some cases.

The outturns per acre as shown in the following table :—

Variety.	Date of sowing.	Outturn per acre.
		Lbs. seed.
1	2	3
1. Phaseolus Lunatus or Rangoon bean or Burma White Bean or "Pebyugale."	24th September 1918	940
	20th October 1918 ..	363
2. Phaseolus Calcaratus or the Rice bean or "Rumbaija" (Khasi Hills).	4th September 1918	437
	20th October 1918 ...	122
3. Kulthi Kalai or Dolichosbiflores...	24th September 1918	315
	20th October 1918 ...	nil.

Variety.	Date of sowing.	Outturn per acre. Lbs. seed.
1	2	3
4. Gram	24th September 1918	123
	20th October 1918 ...	219
5. Mung	24th September 1918	88
	20th October 1918 ...	44
6. Matikalai	24th September, 1918	560
	20th October 1918 ...	35
7. Musuri	3rd October 1918 ...	192
	20th " " ...	298
8. Khesari	3rd " " ...	735
	20th " " ...	1,225

Some of these promise well. Further tests with special regard to time of sowing will be made next season, and it is proposed to sow the Rangoon bean, which is valued highly on the British market, on a field scale for trial.

19. *Fodder crops.*—In paragraph 20 of last year's report mention is made of the commencement of an experiment with Guinea grass, Rhodes grass and Kheri sugarcane for fodder.

Guinea grass was planted out from roots in June 1918. It gave four cuttings in 1918, *viz.*, in August, September, October and November. The drought then stopped its further growth, and the fifth cutting was not obtained until the end of March 1919 after rain. It thus gave practically no crop during the cold weather.

Rhodes grass was grown from seed, and was transplanted from the seed-bed early in August 1918. Small cuttings were obtained in September, October and November 1918, and increas-

ingly large ones in December 1918, February 1919, and again in March 1919. It appeared to stand the drought better than Guinea grass, giving three good cuttings between December 1918 and end of March 1919, as against one cutting of Guinea grass. The Rhodes grass is much finer and softer than Guinea grass, and is said to be more nutritious. Having been grown from seed it did not stand an equal chance with Guinea grass during the year under report, but judging from the results obtained up to date it would appear to be very promising as a cold weather fodder crop.

Kheri cane did fairly well, but is of little use as a fodder producer in the cold weather.

Both Guinea grass and Rhodes grass were planted out in clumps two feet apart each way.

Details of cuttings are given below :—

——	Date of planting.	Area of plot.	Outturn to November 1918.	Outturn to December 1918 to March 1919.	Total outturn per plot.
1	2	3	4	5	6
		Sq. ft.	Mds. srs.	Mds. srs.	Mds. srs.
Kheri cane ...	4th Apl. 1918...	5,285	43 5	3 6	46 11
Guinea grass ...	18th June 1918	3,600	41 2	10 14	51 16
Rhodes grass ...	8th Aug. 1918	3,240	5 28	25 22	31 10

The total outturns of green fodder work out at about 14·1 tons per acre for Kheri cane, 23·5 tons for Guinea grass and 14·2 tons for Rhodes grass.

The areas under Guinea grass and Rhodes grass will be extended during the coming season.

20. *Extension area.*—

Block M—

Cropping { Rains ... ... Dhaincha (green manure).
Rabi ... ... Oats.

Dhaincha made an uneven crop on the limed area, very patchy and irregular, varying from 2 to 12 annas within a few feet all over the block. This land will not be fit for accurate manurial experiments for years.

The Dhaincha on the un-limed area made no growth at all. Oats germinated well all over, but did no good on the un-limed area.

		Mds.	srs.	
Outturn	Limed area	5	19	grain.
	Non-limed area	0	7	„

Blocks O, N & P.—

Blocks N and P were under ratoon cane for distribution.

Block O was half under plant cane for distribution, and the rest was under cowpea for green manure in the rains. In the Rabi season half the block was under Matikalai following cowpeas.

Area under Matikalai was 1¼ acres.

Total outturn Matikalai was 6 maunds 32 seers.

Block R.—An experiment in the use of water Hyacinth ashes was commenced here in 1918. Two plots ¼ acre each were laid out. To one plot Hyacinth ash at the rate of 20 maunds per acre was applied in May 1918. Both plots were cropped with cowpeas green manure in the rains. The cowpeas did much better from the start on the ashes plot.

Previous to sowing the rabi crop of the Khasi Matikalai, (Phaseolus Calcaratus, or the "Rice bean" also known in the Khasi Hills as "Rumbaija") the northern halves of each plot, *i.e.*, ⅛ acre in each case, were cross dressed with 5 maunds per acre Basic Slag, of a very poor quality however.

		Mds.	srs.	
Outturns were—	No manure at all ...	0	26	per acre.
	Basic Slag alone ...	2	0	„ „
	Basic Slag plus Hyacinth ashes	4	6	„ „
	Hyacinth ashes alone ...	4	13	„ „

Thus, while the Basic Slag had some effect alone, it did not increase the yield when added to Hyacinth ash. It is probable that the ashes functioned largely as a neutraliser of soil acidity, *e.g.*, like our wood ashes. They contained some 8·94 per cent. Potash.

21. *Other crops.*—Block A was green manured with Dhaincha after two years cane. The crop was quite twice as big on the phosphate area.

In the Rabi season, Oats followed Dhaincha on part of Block A, yielding at the rate of 800 lbs. grain per acre. The rest of Block A was under mustards, English Yellow and Black

versus Local Yellow and Black. The English varieties germinated very badly and did no good at all. The local varieties did rather better but yielded very poorly. The drought went against them.

Cowpea for seed.—"Jorhat Brown" the farm selected variety, was sown in Block H, in August. The crop did fairly well and was harvested from mid November to end of January. Previous to sowing, the whole block was limed at the rate of 10 maunds slaked lime per acre; it also received 5 maunds rape cake per acre. The eastern part of the block was dressed with 5 maunds Egyptian Raw Phosphate per acre also. The crop was sown about a fortnight later than it would have been on account of very wet weather, and the long cold weather drought reduced the yield somewhat. The yields were 840 lbs. seed per acre from the phosphate and 800 lbs. seed per acre from the unphosphate areas.

Potatoes.—Two plots of 1/20th acre in the kitchen garden; both had cowdung at 300 maunds per acre. One was also dressed with Hyacinth ashes at 10 maunds per acre.

Yields were { Hyacinth ash area 109 maunds per acre.
Other area 75 „ „

22. *Orchard.*—The fruit trees comprise 16 lichis, 6 mangoes, 1 custard appie, 3 sapota, 5 guava, 1 pomelo, 1 plum and 12 oranges. All fruited well except the mangoes. The young orange trees are not yet of bearing age but are making good growth. The only addition during the year was one peach tree. There are four varieties of pine-apples—Ceylon, Kew, Queen and Spanish; all fruited well and there was a large local demand for suckers.

23. *Receipts and expenditure.*—The receipts for the nine months endng March 31st 1919 were Rs. 1,472-7-9 while the total expenditure for the same period was Rs. 7,727-7-1 including Rs. 2,768-15-4 for establishment and Rs. 418-11 capital charges.

24. *Establishment.*—This consists of a Manager on Rs. 100—10—200, a clerk Rs. 25—1-8—40, and a peon on Rs. 8. Four apprentices finished their training during the period under report and were appointed demonstrators on probation in the districts. At the end of the year there were seven apprentices under training including one candidate for scholarship at the Sabour Agricultural College. Since then one of the two vacant posts has been filled, and the other is still vacant pending the selection of a suitable Mohammedan candidate.

25. *Inspection, etc.*—The Hon'ble the Chief Commissioner visited the farm in December 1918. The Director of Land

Records and Agriculture made several inspections, and the work of the farm was closely supervised by the Agricultural Chemist who is resident at Jorhat.

For practically the whole of the material for this report and also for much assistance in drafting it, I am indebted to Mr. A. A. Meggitt, Agricultural Chemist, Assam, who held charge of the farm during my long absence which lasted until nearly the end of the period under report.

A. G. BIRT,

Deputy Director of Agriculture,

Assam Valley.

REPORT OF THE UPPER SHILLONG AGRICULTURAL EXPERIMENT STATION FOR NINE MONTHS ENDING THE 31ST MARCH 1919.

History and description.

1. The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road, 5½ miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the place is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The total area of the farm is 366·67 acres, of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies in a long narrow valley. The bottom of the valley was formerly a marsh which was of very little value for any purpose; it has recently been converted into firm pasture ground by deepening the stream which drains the valley and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil is of a pronounced reddish colour and of great depth. In a small portion of the cultivated area the soil is black owing, it is believed, to the existence of some mineral compound. At the bottom of the valley a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having long been under a thick growth of grass, the upper portion of this soil is a matted mass of half-decayed grass-roots.

In point of quality the soil of the farm is extremely poor and very little can be grown on it without the help of manure.

The greater part of the station suffers from the disadvantages of an exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter the growth of vegetation is entirely suspended.

Purposes of the station.

2. The main objects for which the station is maintained are the trial and introduction of new varieties of potatoes which are the most important among the crops grown on the plateau of the Khasi Hills, the breeding of improved strains of milch cattle suitable for this tract and the cultivation of fodder crops for their up-keep. Fodder experiments have been tried from time to time, but having proved abortive, they have one after another dropped

out of the programme of the farm. Very little experimental work beyond the potato trials is done at present on the farm, and if we leave out the cattle and the fodder crops grown for them, the station may be looked upon more as a seed-growing farm than one devoted to experimental work.

Weather. — 3. The following table gives the rainfal for the period under report :—

Rainfall.

	Actual, 1918-19.	Normal.	Number of rainy days, 1918-19.
1	2	3	4
1918.			
July	28·19	17·75	19
August	16·63	15·67	22
September	10·14	11·06	14
October	3·04	7·55	9
November	0·00	1·27	...
December	0·00	0·18	...
Total for six months ...	58·00	53·48	64
1919.			
January	0·80	0·29	2
February	0·07	1·02	...
March	0·40	2·25	2
Total for three months ...	1·27	3·56	4
Total for nine months ...	59·27	57·04	68

The autumn rainfall being rather less than usual was suitable for hay-making and harvesting of the principal crops. Early frosts stopped the growth of winter potatoes and the crop was a total failure.

A severe drought in spring checked germination of the potato-sets and a period of heavy rainfall in May and June produced conditions favourable to potato disease, with the result that this year's outturn was smaller than even the last year's crop.

The other crops gave a smaller outturn than usual. The upland rice was poor, maize, raishan, and Job's tears crops were moderate. Owing to the extremely heavy downpour of rain in May and June not only were the crops injured on some of the steep hill sides, but considerable damage was done by surface soil being washed away.

Summary of work.

4. The work done during the year included :—

(1) Trials of different varieties of potatoes.
(2) Growing potatoes for seed.
(3) Trials of new crops.
(4) Fodder crops.
(5) Cattle breeding.
(6) Distribution of seeds, implements, etc.

Trials of varieties of potatoes.

5. The total number under this experiment in 1918 was 23 varieties. Where it was possible each variety was planted in duplicate plots of $\frac{1}{40}$th acre each. All the varieties were planted in March and harvested in August, and winter seed was used in each case. The land was manured with 11 tons cowdung and 823 pounds of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 240 gallons per acre applied in two equal doses.

The outturns of each variety in 1918 and in previous years are exhibited in the following table :—

Statement showing the average yield per acre on duplicate plots for the last eleven years.

Variety.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last eleven years.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	
1. King of Potatoes	5·94	4·97	9·20	6·33	8·0	6·84	8·58	7·37	4·82	3·51	11·7	7·12	
2. Magnum Bonum (1908) ...	4·51	5·28	9·25	6·77	7·85	6·07	8·51	5·90	4·86	3·22	10·16	6·88	
3. King Edward VII	2·75	3·56	7·35	4·61	6·17	4·90	4·58	6·0	2·88	3·31	9·87	4·84	
4. Khasi Nainital	3·64	4·12	8·71	5·48	6·93	6·39	6·11	5·78	4·36	4·10	10·7	5·90	
5. Khasi Round	2·27	2·89	5·89	4·98	4·52	4·51	4·09	4·95	3·40	3·76	9·35	4·16	
6. British Queen (1909)	3·32	4·75	9·12	7·36	7·19	5·60	6·66	6·96	3·40	...	...	6·28	
7. Up-to-Date	4·94	4·61	9·75	6·12	7·62	6·84	6·53	5·61	3·30	...	...	6·03	
8. Magnum Bonum (1913) ...	3·33	4·95	8·91	4·93	6·24	5·72	8·22	...	...	...	...	6·04	
9. Windsor Castle (,,) ...	4·27	6·49	10·12	6·20	8·75	4·73	7·19	...	...	...	...	6·82	

Variety.	1218.	1917.	1916.	1915.	1614.	1913.	1012.	1911.	1910.	1900.	1908.	Average of last eleven years.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14
10. British Queen (1912) ...	3·01	3·0	7·95	6·19	6·66	5·23	2·66	...	...	...	...	4·95	
11. Flour Ball	3·78	2·05	4·54	4·94	5·22	5·9	6·35	...	...	...	...	4·08	
12. Imperator	4·60	4·88	7·86	6·84	6·73	6·14	7·74	...	...	...	...	6·39	
13. Magnum Bonum (1915)... ...	2·27	2·56	2·34	...	...	...	...	...	...	...	...	2·39	Average for 3 years.
14. Up-to-Date (,,)... ...	4·48	3·82	2·16	...	...	...	...	...	...	...	...	3·48	Ditto.
15. Windsor Castle (,,)... ...	3·01	3·96	1·70	...	..	...	...	...	...	...	...	2·89	Ditto.
16. Stirling Castle (,,)	3·37	5·19	2·57	...	...	...	...	...	...	...	...	3·71	Ditto.
17. Epicure- (,,)... ...	2·93	3·27	4·71	...	...	...	...	...	...	...	...	3·63	Ditto.
18. Edinburgh Castle (,,)... ...	2·09	6·75	2·80	...	...	...	...	...	...	...	...	3·88	Ditto.
19. Dover Castle (,,)... ...	2·31	2·42	3·38	...	...	...	...	...	...	...	...	2·70	Ditto.
20. Balmoral Castle (,,)... ...	3·6	2·20	2·37	...	...	...	...	...	...	...	...	2·72	Ditto.
21. Acquisition (,,)... ...	1·43	4·29	1·28	...	...	...	...	...	...	...	...	2·33	Ditto.
22. Arran Chief	0·73	1·32	...	...	...	...	...	...	...	...	...	1·02	Average for 2 years.
23. King of Potatoes (1916) ...	4·00	4·92	...	...	...	...	...	...	...	...	...	4·46	Ditto.

The same 23 varieties are under experiment in the present year. As in former years, 50 tubers of each variety were selected at random, cut open, and examined for signs of disease. The following table gives the result of the examination in the last eight years :—

Varieties.	Number of diseased tubers out of 50 examined.								
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.
1	2	3	4	5	6	7	8	9	10
King of Potatoes	13	nil.	nil.	nil.	1	5	3	nil.	2
Magnum Bonum (1908)	6	4	2	4	2	nil.	1	nil.	4
King Edward VII (1906)... ...	18	8	4	6	5	4	1	nil	1
Khasi Naimital (1908)	48	16	8	4	4	8	nil.	1	6
Khasi Round (1900)	4	8	6	10	6	6	10	3	7
British Queen (1909)	12	...	6	4	2	8	2	nil.	1
Up-to-Date (1900)	4	32	16	4	1	6	4	1	nil.
Magnum Bonum (1912) ...	...	...	6	6	2	2	1	5	3
Windsor Castle (1913)	...	...	4	3	2	10	1	nil.	nil.
British Queen (1912)	...	...	4	4	3	6	1	1	3
Flour Ball (1912)	...	...	6	3	1	10	1	1	nil.
Imperator (1912)	...	...	23	3	3	4	6	nil,	2
Stirling Castle (1915)	...	...	...	...	...	...	10	nil.	5
Epicure (1915)	...	...	...	...	...	...	5	1	6
Magnum Bonum (1915)	...	...	...	...	...	...	5	nil	3
Dover Castle (1915)	...	...	...	...	...	...	4	1	4
Up-to-Date (1915)	...	...	...	...	...	...	1	1	4
King of Potatoes (1916)... ...	...	...	...	...	...	...	...	nil.	nil.
Windsor Castle (1915)	...	...	...	...	...	..	2	8	1
Edinburgh Castle (1915) ..	...	...	...	...	...	...	3	nil.	nil.
Acquisition	...	...	...	...	...	...	...	3	nil.
Balmoral Castle	...	...	...	...	...	...	1	3	2
Arran Chief	...	...	...	...	...	...	...	2	2

Potato disease caused by Phytophthora Infestans is often responsible for considerable damage to the potato crop in the Khasi Hills. This year the damage to the farm crop was greater than usual, owing to growth being delayed by an early drought, which was followed by rather heavy rainfall in May and June, and an

early appearance of potato blight. Preventive spraying is as thoroughly and systematically carried out on the farm every year as weather conditions permit.

In the present year part of the crop was sprayed twice with Bordeaux mixture, at 120 gallons per acre each time, the balance being sprayed once at the same rate.

Notwithstanding this treatment, growth ceased early and the crop is even smaller than in the previous year.

During the year under report three new varieties were obtained from England, *viz.*, Arran Chief, Edinburgh Castle and Stirling Castle.

Potato seeds from St. Andrew's University.

Twenty lots of seed were obtained in February 1916 from St. Andrew's University, through the kindness of Donald Ferguson, Esq., of Dhamai Tea Estate, Sylhet, Honorary Correspondent of the Department. Half of each lot of seed was sown in boxes on 20th February 1916, and the remaining half was sown similarly on the 19th March 1916. Out of twenty lots, numbers four and twenty failed to germinate. The others grew satisfactorily, and the seedlings were planted in the field on the 15th May 1916.

Two lots of seed produced only one plant each, and as one of these plants failed to form any tubers, the total number was reduced to seventeen. Two lots were destroyed by insects and the remaining seventeen have given widely varying yields in the past two seasons. Calculating the yields to a uniform amount of one seer of seed of each variety, the outturn has varied from 4 to 56 seers. These varieties are being grown on a larger scale in the present year and it is probable that several good varieties will be found among them.

Potato manurial experiment.—An experiment designed to shed some light on the respective manurial values of rape cake and bonemeal for the potato crop was carried out in 1916 and 1917 and repeated in the present year. This experiment was put down in duplicate on a series of plots of King of Potatoes, and a similar duplicate experiment was carried out with

Magnum Bonum. The seed rate was 987 pounds per acre. The manures used and the yields obtained per acre in 1918 are shown in the accompanying table :—

1	2	3	4	5	6	7
Manures used per acre.	Cowdung. 5·5 tons.	Cowdung 5·5 tons, rape cake 823 pounds.	Rape cake 823 pounds.	Bonemeal 823 pounds.	Cowdung 5·5 tons, bonemeal 823 pounds.	Rape cake 823 pounds, bonemeal 823 pounds.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
King of Potatoes	1·89	1·93	·88	1·87	3·83	2·36
Magnum Bonum	1·91	2·78	·66	1·55	3·10	2·56
Total ...	3·80	4·71	1·54	3·42	6·93	4·92
Average yield per acre ...	1·90	2·35	·77	1·76	3·46	2·46

Bonemeal and rape cake were used not because they were considered the most suitable for the potato crop, but because they are practically the only manures, other than cowdung, which are known to the cultivators of the Khasi-Hills.

From the yield obtained it would seem that bonemeal is more effective than rape cake both when used as a supplementary dressing with cowdung and when used alone. These manures are again under experiment in the present season.

Sprouting seed potatoes.

6. It is the custom among Khasi cultivators to grow an autumn crop of potatoes, principally for the purpose of using the produce for seed for the following spring crop. This custom has been followed at the farm for some years but, owing to the exposed situation of the farm, it has been found that the yield of the autumn grown crop is so small as to make seed produced in this way extremely expensive. With the object of finding a cheaper source of seed, the method of boxing summer sets was tried. The method consists of placing the seed potatoes in shallow boxes specially made for the purpose, and of storing them in a

well-lighted but not too airy shed. Under conditions of moderate temperature and moisture the sets keep satisfactorily and produce short, well formed sprouts which grow at a slow rate. These sets can be planted out from the boxes at the ordinary planting season and are then likely to grow rapidly.

During the past season this method was carried out in the following manner. Potatoes from the summer crop of 1917, valued at Rs. 2-8-0 per maund, were placed in sprouting boxes and kept there during the cold weather 1917-18. In the spring of 1918 these sprouted summer sets were planted alongside unsprouted winter sets valued at Rs. 5 per maund. The size of sets and weights used per acre were approximately the same. Similar conditions of cultivation, manuring and spraying were observed for both lots, and as the experiment was tried with six of the main crop varieties, the results may be taken as fairly conclusive.

The average of the yields obtained from unsprouted winter seed was 4·41 tons per acre, while the average obtained from sprouted summer seeds was 4·45 tons. This is a satisfactory result, and if confirmed in future years would be capable of profitable expansion both on the farm and on areas outside of it.

Potatoes of seed.

7. Six varieties of potatoes were grown during 1918 for the production of seed. These varieties were King of Potatoes, Magnum Bonum, Up-to-Date, Windsor Castle, British Queen and Imperator. The crop was planted in March and harvested in August. The total area planted was 7·04 acres as against 7·4 acres in 1917. The manures used were, as in previous years, 5·5 tons of cowdung, and 823 pounds of rape cake per acre. The crop was sprayed once with Bordeaux mixture at the rate of 120 gallons per acre. The outturn was as follows :—

Variety.	Area, in acres.	Total yield, in tons.
1	2	3
King of Potatoes	2·20	6·46
Magnum Bonum	1·62	2·25
Up-to-Date	·87	·59
Windsor Castle	1·00	2·24
British Queen (19^9)	·4	·72
Imperator	·95	2·61
Total	7·04	14·87

The average yield per acre amounted to a little over 2·11 tons against 3·2 tons in 1917.

For the present year about 5 acres have been planted in March with the same 6 varieties. The demand from the plains for seed potatoes grown on the Shillong Farm is extending rapidly. In order to meet this increased demand, the area under this crop has been extended as far as practicable with the quantity of cattle manure which is available. Even then there is an insufficient supply for the requirements of both hills and plains districts. To still further increase the supply, arrangements were made in 1917 to cultivate an extra area of potatoes under the *Jhum* system and this has been continued since. In that year an area of 16½ acres was planted on the farm lands according to this system in 1917 10½, in 1918 $10\frac{1}{10}$ acres, and in the current year about 6 acres have been so planted.

An agreement was made with Khasi cultivators to carry out this work. The terms were that the farm should provide the land and the seed, and the cultivators should do the work and return to the farm one and a half times the seed supplied. The cultivators also undertake to sell, at bazar rates, whatever additional quantity of seed may be required. In 1918, the farm supplied for this purpose 3·78 tons and in return received 6·91 tons. This included 1·23 tons received as payment for the work of spraying the crop with Bordeaux mixture, which was done by the farm workers.

In the present year 6 acres are being cultivated under a similar agreement. The farm supplied 1·76 tons and it is expected that the return will be about 2·83 tons. With the object of increasing the supply of seed potatoes suitable for distribution in the plains, a scheme has been started by which Khasi cultivators undertake to grow on their own lands, seed potatoes supplied by the farm. The seeds are supplied free on the cultivator entering into an agreement to keep the crop pure and to return to the Department, from his crop, one and a half maunds for each maund supplied free. One hundred and fifty maunds have been distributed on these terms for the present planting season. The total quantity of potatoes available for disposal last year (1918) was 26·59 tons made up as follows:—

	Tons.
Farm grown crop taking summer and winter crops together	19·49
Seed returned by the *jhum* growers	6·91
Purchased from *jhum* cultivators	·19
Total	26·59

This quantity was disposed of as follows :—

	Tons.
Sold to Khasi cultivators	6·8
Supplied to Gauhati Seed Depôt and other places in the province through the Agricultural Officers ...	5·00
Sold direct from the farm to officials and private individuals outside the Khasi Hills	·22
Total quantity supplied for seed ...	12·02
Used on the farm and *jhum* area for planting ...	9·08
Dryage and rottage and feed of cattle ...	5·49
Total	26·59

The price charged to Khasi cultivators for seed potatoes supplied was the market price for table potatoes for the time being which was about 2-8-0 per maund.

Damaged potatoes and potatoes which were unsuitable for seed were fed to the farm stock

The seed potatoes sold consisted of 4·45 tons of King of Potatoes, 2·18 tons of Magnum Bonum, 1·53 tons of Up-to-Date, 2·85 tons of Windsor Castle, ·55 tons of Imperator, and ·46 tons of British Queen.

Wet rice.

8. Experiments on the warping of rice land have been carried out on wet rice land for the past few years. As the results were unsatisfactory the experiments have been discontinued. During the year the land was utilized for trials of lime and bonemeal on wet rice.

The following two series have been laid down :—

First series, Lime experiment.—Duplicate plots of $\frac{1}{10}$th acre each have been manured with lime at the rates of 10 maunds, 20 maunds and 30 maunds per acre, respectively, and four plots remained unmanured as control. All the resulting crops were very poor; only the heavily limed plot showed some slight improvement.

Second series, Lime versus *Bonemeal.*—Duplicate plots of $\frac{1}{10}$th acre each have been manured with bonemeal at 3 maunds per acre and another series of duplicate plots with lime at 30 maunds per acre. The rest remain as control plots. The results were $6\frac{1}{2}\frac{1}{0}$ maunds from bonemeal, $1\frac{3}{8}$ maunds from lime and 2 maunds from the unmanured plots.

For both experiments, the seed was sown early in May at the rate of 40 seers per acre. When the seed was about to germinate heavy rainfall set in and consequently the germination was uneven and the results unsatisfactory.

Naga Hills rices.—Two varieties of rice from the Naga Hills, *viz.*, Rhelaw and Thavier, were tried at the farm in the past season. These were sown at about the same time as the above on land of ·4 acre. Germination was satisfactory but the crop flowered so late that it had not time to mature before frosts came.

New crops.

9. *Buckwheat.*—This crop has been recently introduced into the district by Nepalese settlers, and although the returns have not been very large, it seems to have possibilities on the Khasi Hills, as the cost of cultivation is so small. When the seed is sown immediately after the potato crop is dug, no extra cultivation is required. On the farm this course was followed satisfactorily for the first two years of the experiment. In subsequent years the crop has been disappointing owing to early frosts. In July 1918 one acre of potato land was sown but owing to early stoppage of growth the result was that only 1 maund 6 seers of seed was gathered. The outturn would have been much greater if the crop had ripened properly.

Rhubarb.—This crop was first planted in 1912, on a plot of land about $\frac{1}{10}$th of an acre in extent. Two additional plots have been planted since—$\frac{1}{20}$th acre in 1915, and $\frac{1}{3}$ acre in 1918. The land was manured with cowdung at the rate of ·11 and lime ·36 tons per acre. During the month of July 1918 about 46 lbs. of stalks were sold realizing Rs. 5-12-0. A total of Rs. 60-12-0 was realized in the season from ·15 acre but Rs. 55 of this was received in the previous financial year. The plants are growing well.

Strawberries.—In September 1916 an additional plot of $\frac{1}{20}$th acre was planted with two varieties of strawberries obtained from the Fruit Experiment Station, Shillong. These plants grew well and in October 1917 another $\frac{1}{10}$th of an acre was planted with the suckers of these two varieties. The plot planted in 1912 is $\frac{1}{40}$th acre. The total area at present is about ·17 acre.

All the plots were manured last winter with cowdung and bonemeal at the rate of 11 tons and 247 pounds, respectively. The strawberry plants are growing well but, owing to the severe spring drought, they flowered late in the season and most of the fruits were destroyed by heavy rains in May.

Only about 8 pounds of fruits have been picked and sold during the year, and the return therefrom was Rs. 5-12.

Other fruits.—A few of the trees on the farm bore fruits. These were sold and realised the following sums :—

	Rs.	a.	p.
Apples	4	1	0
Peaches	1	7	0
Chestnuts	4	2	0
Plums	0	5	0

Fodder crops.

10. The following fodder crops were grow during the year :—

Names of crops.	Area sown.	Cost of cultivation.	Outturn of green fodder.
1	2	3	4
	Acres.	Rs. a. p.	Tons
Maize	13·6	435 8 8	25·72
Job's tears	13·27	359 12 5	10·30
Jhum area	5 Approx.	...	6·69
Total	31·87	795 5 1	42·71

The maize crop gave a very poor yield. Job's tears did well on the *jhum* area, but the farm crop was poor.

The whole of this fodder (42·71 tons) was made into ensilage. From this quantity of green material 35·33 tons or 82 per cent. was recovered as ensilage of good quality.

The total cost of silage was Rs. 962-12-9, made up of cost of cultivation Rs. 795-5-1, cost of carrying the fodder, chopping, and packing in the silo Rs. 167-7-8.

The proportion of loss through decay around the sides of the pit in which the ensilage was made, was somewhat similar to that of the previous year. The cost per ton of silage was Rs. 25-10-0 as compared with Rs. 19-9-0 in the previous year.

Raishan (Paspalum Sanguinale)—has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. Raishan was grown on an area of 13·27 acres and the produce was made into hay and fed to the cattle

during the winter months. In addition to Raishan, about 1·9 acres of soybean and ·65 acres of hill paddy were grown and the product mixed with the hay.

A total amount of 14·95 tons of hay was fed during the year. The cost was Rs. 436-0-5 or a little over Rs. 28-14-0 per ton of hay as compared with Rs. 32-4-0 in 1918.

The quality of this fodder was good, and all was eaten by the cattle.

Cattle breeding.

11. The following table shows the number of cattle in the herd on 31st March 1919 :—

Descriptions.	Montgomery.	Montgomery × Ayrshire.	Montgomery × Patna.	Montgomery × Patna × Bhutia.	M×P×B×P.	M×P×B×P×P.	M×Bhutia.	Patna.	Bhutia (B).	P×B.	P×B×P.	P×B×P×P.	P×B×P×P×P.	P×Khasia (K).	Total on 31st March 1919.	Total on 30th June 1918.	Total on 30th June 1917.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Breeding bulls ...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	2	1	1	
Bulls (3 years and above).	1	1	...	...	...	...	...	1	...	...	3	2	...	2	10	6	3	Are being used as plough.
Bulls (2 to 3 years) ...	...	...	...	...	...	...	...	4	...	...	...	1	...	...	5	9	7	
„ (1 to 2 years) ...	...	...	1	1	1	2	...	3	...	...	...	...	...	...	8	6	8	
„ (under 1 year) ...	...	...	3	1	1	...	...	...	...	...	...	...	...	...	5	10	6	
Heifers (2 to 3 years)	...	...	...	...	...	...	...	3	...	1	1	...	...	...	5	10	10	
„ (above 3 years)	...	...	...	...	...	...	...	6	...	1	2	...	...	...	9	5	1	
„ (1 to 2 years) ...	...	...	1	1	3	...	1	2	...	...	2	1	1	...	12	7	12	
„ (under 1 year)	...	...	5	2	4	...	1	...	...	...	...	...	...	...	12	14	9	
Cows	...	...	...	...	...	...	...	12	1	5	9	3	...	...	30	32	20	
Total on 31st March 1919.	2	1	10	5	9	2	2	32	1	7	17	7	1	2	98	...	...	
Total on 30th June 1918.	2	1	4	4	3	4	1	39	1	5	14	14	3	2	...	160	...	
Total on 30th June 1917.	1	...	...	...	...	...	...	40	1	3	14	15	4	2	...	...	86	

In addition to the above, there were at the end of the period two Hindustani, 8 Khasi and 2 Manipuri bullocks. The total number of cattle was therefore 110 against 111 on the 30th June 1918.

Two young bulls, of the Taylor breed from Patna, of 4 and 2 years old, respectively, were purchased for breeding purposes from Sonepur fair and the two Manipuri bullocks above mentioned were obtained from Karimganj farm during the year.

The total yield of milk during the period under report amounted to 1,983 gallons, out of which about 105 gallons were fed to calves and the remainder was sold at the rate of 14 lbs. for a rupee from June to 31st December 1918, and at 13 lbs. for a rupee from 1st January to 31st March 1919.

The cost of maintenance of the herd amounted to Rs. 4,903-0-11. The income from the sale of milk amounted to Rs. 1,407-11-10 and the value of the cattle sold to Rs. 753.

The half English-Patna cattle and the progeny of their cross with Khasi and Bhutia breeds have proved remarkably well adapted to the climate of the Khasi Hills. In respect of milking capacity these cattle stand head and shoulders above any cattle on this side of India.

The demand for these cattle continues keen, but is still practically confined to tea planters and a few people about Shillong who are experienced in the care of cattle. As the herd was becoming somewhat large for the grazing and other food resources of the farm, and the cost of purchasing food in large quantity prohibitive, it was considered advisable to sell off a few of the older and poorer stock, to allow of expenditure being kept within reasonable limits. It is probable that a further number will be sold off before next cold weather as the stock is still too large.

The breeding bulls are generally in demand as fast as they reach the three years of age at which they are considered fit for disposal, but at the present time there are a few bulls on hand owing to some orders having recently been withdrawn.

During the period under report one bull was sold to the Political Officer at Sadiya, three to tea planters of the province, two were sent to Karimganj in exchange for two bullocks received from the farm there, and fifteen of the poorer cattle of various ages and condition were sold by public auction at Shillong.

The cost of maintaining the herd is becoming higher owing to the rise in prices of all food stuffs. It might be possible to reduce the expenditure by separating the cows from the rest of the herd and maintaining them purely with a view to profit.

The present herd of Patna cattle is far superior to the cattle of the province, and it would undoubtedly be advisable to maintain this breed if that were possible. Ineffective attempts were made to obtain young bulls from the Patna district in recent years; however during the year under report, two young Patna bulls of the desired type were purchased at Sonepur fair and arrangements are being made to keep the original Patna strain as pure as possible.

During the month of August 1918 there was a serious outbreak of foot-and-mouth disease among the farm herd. The Veterinary Assistant attended regularly at the farm during this time and, largely owing to the care and attention given by him, our losses were restricted to two newly born calves.

Distribution of seed and plants.

12. The following were the seeds and plants supplied to agriculturists during the year :—

	Tons.	Number.
Seed potatoes	12·02	...
Rhubarb roots	...	32
Pear grafts	...	12
* Oilcake for manure	2·20	...

* This was not sold direct from the farm but was recommended and procured for the cultivators.

Establishment.

13. U Herrick Singh continued in the position of Farm Manager during the year. He took privilege leave for two months and U L. Harry Singh acted during his absence. U Shetro Mohan Jyrwa continued in the position of Farm Clerk.

Two apprentices, Gloshon Singh and Sedro Singh, completed their two years' course of Practical Training. U Owellmuni and U Melancton have since been appointed apprentices. In addition to these apprentices one Khasi and one Garo candidate apprentice are being entertained. These young men work with the labourers and are paid at the ordinary rates.

A Lushai Demonstrator has recently been deputed for further training at the farm, and is now working with the other apprentices.

14. The total receipts, including the value of seed potatoes used for demonstration purposes in the province, were Rs. 3,013-0-10.

Receipts and expenditure.

The sale of milk produced Rs. 1,407-11-10, the sale of cattle Rs. 750, while potatoes sold direct from the farm realised Rs. 468-15-0, and in addition, potatoes to the value of Rs. 340-13-0 were supplied for demonstration purposes throughout the province.

The total expenditure for the period under report amounted to Rs. 13,357-12-1 against Rs. 14,455-10-11 in the previous twelve months. The details are as follows :—

	Rs.	a.	p.
Establishment	1,884	5	8
Petty construction	1,514	12	2
Feed of cattle	3,948	8	2
Seed, plants and manures	486	13	3
Wages of farm labourers	3,300	7	3
Petty repairs	1,144	5	2
Purchase and repair of furniture	88	2	6
Service postage and telegrams	30	0	0
Unspecified charges	454	5	9
Purchase of cattle	307	6	9
Reclamation	198	9	5
Total	13,357	12	1

The expenditure was heavy owing to the high prices of food stuffs, manures, etc., and also to the fact that a new area of about 16 acres has been permanently reclaimed. A sum of Rs. 1,514-12-2 was spent on erecting a permanent wire fence and a new cattle food godown.

CAMP SILCHAR,
The 29th April 1919.

J. W. McKAY,
Deputy Director of Agriculture, Assam.

REPORT OF THE FRUIT EXPERIMENT STATION, SHILLONG, FOR NINE MONTHS ENDING THE 31st MARCH 1919.

1. *Introductory.*—The Fruit Station commenced work in October 1912 : planting was commenced in the spring of 1913. The land is situated on the south side of the Jowai road, distant about a mile from Shillong. The elevation is about 5,100 feet. The total area is 62 acres, of which about 30 acres is suitable for fruit growing : 28¾ acres have been planted.

2. *Lower Garden.*—No extension to this block has been made since 1913-14. The planted area is 4¼ acres in grounds of 6·13 acres : the fruit trees are planted 15′×15′ diagonally. The soil of this block varies from light sandy loam lying above stone to heavier loam of good depth. The following varieties on the heavier loam continue to improve in growth and yield—James Grieve, Kerry Pippin, Rymer, Bismarck, Peasgood's Nonsuch, Devonshire Quarrenden, Crimson Bramley, Bramley's Seedling, Lane's Prince Albert. The following varieties yielded sparsely :—Red Juneating, Mr. Gladstone, Warner's King, Scarlet Nonpareil, Alfriston, Yellow Ingestre. Of the others Ribston Pippin, Cox's Orange Pippin, Hounslow Wonder, Hector MacDonald, Cox's Golden Drop, Golden Reinette bore a few fruit ; and Manning-ton Pearmain, Barnack Beauty, Coronation, Wealthy, Roundway Magnum Bonum, Fearns' Pippin, Rosemary Russet, Newton Pippin, did not bear fruit. On the lighter soil only the stronger growing varieties have succeeded, *viz.*—Encore, Bramley's Seedling, Crimson Bramley, Newton Wonder, Lady Sudely, Norfolk Beauty, Potts Seedling, Peasgood's Nonsuch, Alfriston, Lane's Prince Albert, Allington Pippin, Red Victoria, Kerry Pippin, Rymer. Of the varieties planted in place of ones of weaker growth that failed, Rev. W. Wilks, Worcester Pearmain, Bismarck, William Crump, Syke House Russet, Ardcairn Russet, Upton Pyne, Bens Red, promise best : the other varieties planted last year, *viz.*, Grenadier, Star of Devon, Charles Eyre, Lord Derby, did not bear fruit.

The Pear trees suffered from the drought in March and April and put on very little new growth. Of the Bush trees Fertility, St. Swithin, and Fondante Thirriot bore good crops for the size and age of the trees. As far as can be now judged, Fertility is a great bearer and should be useful for market : St. Swithins

an early variety, is a prolific bearer, but is small and a poor keeper: Fondante Thirriot, is a large white-fleshed pear that promises well for market. Madame Treyve, Durondeau, Beurre d' Amanlis, Emile d' Heyst, bore fruit for the first time.

The following Espalier trained trees bore well:—Fondante d' Automne, medium size, flesh very tender and deliciously sweet: Marguerite Marillat—very large, uneven in outline, which did not ripen well this year, William bon Chretien—large melting and of strong musky flavour. [This well known fruit, whose name is freely adopted for any pear, was raised by a school master named Stair of Aldermaston about 1770. In that county it is still called "Stair's Pear", it took its name "Williams" from its distributor, a nurseryman of Turnham Green. On its introduction to America it was again renamed after its importer Mr. Bartlett.] Louise Bonne of Jersey—medium size, a delicious melting white-fleshed pear.

The Cherry trees suffered badly from the drought, and flowering late only a few set on the "Kentish" trees. The "Peregrine" was the only variety of the Peaches that ripened well: first class fruit was picked from the trees from 17th June to 5th July. The "Kestrel" trees bore a good crop, but incessant rain from the 7th to 15th July spoilt them as they were ripening. The 2 Exquisite Peach trees bore well for the first time, the fruit ripening at the end of July. The fruit is yellow-fleshed freestone of poor quality compared to the earlier varieties. The other varieties flowered late owing to the drought, and yielded only a few undersized fruits.

The 3 varieties of Plum trees left in this garden for further experiment on light soil, *viz.*, Deniston's Superb Gage, Belle de Louvain, Belgian Purple, bore only a few fruit. One of the Langley Bullace trees bore a big crop of dark purple culinary fruit. This variety was raised by Messrs. Veitch (Farleigh Damson X Early Orleans Plum) and introduced in 1902. It is evidently, as described by the raisers, of great fertility and promises to succeed in this climate. The "Merryweather's Damson" trees bore well and the fruit is all the raisers—Messrs. Merryweather and Sons, claim for it; it could readily be mistaken for a late plum until tasted: although the size is so much above that of the largest Damson grown, the true flavour of the Damson is retained. The Giant Himalaya Berry of California and the Blowers are the best of the varieties of Blackberries and the King's Acre Berry, the best of the Hybrid Berries. None of the fruit came to perfection owing to the excessive rain in July, when they were ripening. The Raspberries showed no improvement and have been discarded. White la Versaillaise White Currants fruited

and further trials will be made with this variety. The Black Currants transplanted to shady sites have put on good growth but have not fruited. The land has been kept in good cultivation during the year. The lighter soil was again found to be infested with cockchafer grubs necessitating removing the soil round the trees to destroy them. A great many were also killed when the garden was deep hoed. During May and June the cockchafer beetles were caught in thousands by lamp light after dark. Calyx spraying with Arsenate of Lead solution was done, but this may not be the remedy for the grub in the Apple, which Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Pusa, has discovered is the larva of a weevil, an insect that eats small patches in the fruit and oviposit in excavations along the edges of such patches. The control of this pest is of the greatest importance in an Apple Orchard. There is also a brown weevil that attacks apple shoots. A large blackish weevil, is very destructive to Fig trees and although grubs are destroyed as noticed, the damage done eventually kills the tree. There are a great many sucking insects that do damage which will be difficult to control when the trees grow bigger: at present they are caught by hand and destroyed.

3. *Upper Garden.*—The area planted is 24½ acres, of which 10½ acres was planted in 1914, 2 acres in 1915, ½ an acre in 1916, 5¼ acres in 1917, 2¼ acres in 1918, 4 acres in 1919. It is divided into 7 blocks, *viz.* :—

Top block.—Area 1¾ acres, planted in 1914 with Bush Apple trees 15′ × 15′ diagonally.

North block.—Area 1½ acres, planted in 1914 with Standard Apple trees 34′ × 34′ diagonally, interplanted with Bush Apple trees 17′ × 17′.

South block.—Area 5¼ acres, planted with Standard Apple trees 30′ × 30′ diagonally, interplanted with Bush Apple, Pyramid Pear, Cherry and Plum trees 15′ × 15′, ¾ acre planted in 1914, ¼ acre in 1915, ½ acre in 1916, 2¾ acres in 1917, 1 acre in 1918.

East block.—Area 8¼ acres ; 7 acres is planted with Standard Apple trees 34′ × 34′ diagonally, interplanted with Bush Apple trees 17′ × 17′; 5½ acres planted in 1914, 1½ acres planted in 1915. The remaining 1¼ acres was planted in 1918 with Standard Pear trees 25′ × 25′ diagonally.

South-west block.—Area 4 acres, planted in 1919 with Standard Apple trees 30′ × 30′ diagonally, partly interplanted with Bush Apple and Plum trees 15′ × 15′.

East block extension.—Area 2½ acres, planted in 1917 with Standard Apple trees 30′ × 30′ diagonally, interplanted with Bush Apple trees 15′ × 15′.

West block.—Area 1¼ acres, planted with Standard Pear trees 25′ × 25′ diagonally, interplanted with Bush Pear trees 12′ 6″ × 12′ 6″ ; 1 acre planted in 1914, ¼ acre in 1915.

The soil of the Upper Garden is a good loam of about 12 inches depth lying on a red sub-soil. Small plots have a hard pan sub-soil about 2½ feet from the surface. The whole of the planted area has been terraced with stone and banks. It has successfully prevented the denudation of the soil by rainfall.

The following statement shows the varieties of the Apples and Pears grafted in 1916 and 1917 :—

Varieties and Stock.	North block.		Top block.		East block.		West block.	
	1916.	1917.	1916.	1917.	1916.	1917.	1916.	1917.
1	2	3	4	5	6	7	8	9
APPLES GRAFTED ON CRAB STOCK.								
Bismarck	...	245	...	...	40	31	...	...
James Grieve ...	...	827	...	...	73	111	...	...
Kerry Pippin... ...	...	88	...	...	52	70	...	...
Lane's Prince Albert ...	...	...	...	...	15	20	...	...
Rev. W. Wilks ...	...	70	...	104	7	12	10	...
Stirling Castle ...	...	91	...	...	4	3	...	...
Red Victoria... ...	...	...	...	...	7	46	...	...
Crimson Bramley's Seedling.	...	...	...	...	24	36	...	...
Bramley's Seedling ...	...	...	...	...	20	22	...	...
Alfriston	...	...	...	...	40	131	...	...
Bess Bed	...	...	...	...	25	56	...	...
Rival	...	...	...	...	48	69	...	...
Domino	...	...	...	...	55	65	...	...
Norfolk Beauty ...	...	83	...	...	...	...	...	...
Total ...	...	1,404	...	104	410	687	10	...

Varieties and Stock.	North block.		Top block.		East block.		West block.	
	1916.	1917.	1916.	1917.	1916.	1917.	1916.	1917
1	2	3	4	5	6	7	8	9
APPLES GRAFTED ON PARADISE STOCK.								
Bismarck ...	...	...	...	...	...	65	...	...
James Grieve...	...	...	...	...	...	171	...	...
Kerry Pippin ...	...	...	...	...	...	109	...	...
Rev. W. Wilks ...	...	...	...	...	...	72	...	...
Devon Queen... ...	...	...	...	...	...	27	...	...
Barnack Beauty ...	...	...	...	...	...	19	...	...
Ellison's Orange ...	...	...	...	...	...	26	...	...
Total ...	...	...	...	...	...	489	...	...
PEARS GRAFTED ON PEAR STOCK.								
Fertility	...	...	...	...	...	...	47	352
Marguerite Marillat ...	...	...	...	...	...	...	...	42
Fondante Thirriot ...	...	...	...	...	...	...	...	23
Bartlett	...	...	...	...	...	...	...	21
Total ...	...	...	...	...	...	...	47	438
PEARS GRAFTED ON QUINCE STOCK.								
Doyenne du Comice ...	...	...	...	...	...	...	...	98
Madame Treyve ...	...	...	...	...	...	...	...	114
Louise Bonne of Jersey...	...	...	...	...	...	...	...	57
Marguerite Marillat ...	...	...	...	...	...	...	...	79
Fondante Thirriot ...	...	...	...	...	...	...	...	61
Princess	...	...	...	...	...	...	...	87
William's Bon Chretien ...	...	...	...	...	...	...	...	73
Bartlett	...	...	...	...	...	...	...	109
Lincoln	...	...	...	...	...	...	...	11
King Karl	...	...	...	...	...	...	...	6
Howell	...	...	...	...	...	...	...	20
Anjou	...	...	...	...	...	...	...	15
Duchess	...	...	...	...	...	...	...	15
Triumph	...	...	...	...	...	...	...	15
Boussock	...	...	...	...	...	...	...	6
Total ...	...	...	...	...	...	...	...	816

The following varieties of Apples in this garden have so far yielded best of the Bush trees :—James Grieve, Lane's Prince Albert, Upton Pyne, Bismarck, Rev. W. Wilks, Domino, Sturmer Pippin, William's Favourite, Kerry Pippin, Peasgood's Nonsuch, Lady Sudely, Encore, Bramley's Seedling, Newton Wonder, Charles Ross, Alfriston, Boston Russet, Royal Snow, Wadhurst Pippin, Eckinville Seedling, Allington Pippin, William Crump, Irish Peach, Lord Grosvenor, Jefferson.

A few varieties of the Standard trees fruited for the first time; the trees have put on good growth. The following varieties of Pears fruited :—Fertility, Princess, Marguerite Marillat, William's Bon Chretien, Doyenne d' Ete, Charles Ernest, Dr. Jules Guyot, Durondeau, Beurre d' Amanlis, Colmar d' Ete, Belle Julie, Fondante Thirriot. The trees have put on a better growth than the Lower Garden ones, and the site of the West Block appears to be favourable: the trees are too young to judge as to quality and yield; only the stronger trees were allowed to set a few fruit and these were promising. None of the English Plums bore fruit and growth was poor; the American varieties—Shiro, Gold, Omaha—have grown well and bore a few fruits of good quality. None of the Orange trees have yet borne fruit. The whole area of this garden has been kept well cultivated, and the trees have put on very satisfactory growth. The Strawberry crop owing to the drought was a failure. New beds of "Royal Sovereign" have been planted in the South Block. Pruning commenced on the 2nd January and was finished on the 28th February. The deep hoeing was finished on the 7th March. Four acres was added to the planted area this year. The whole of the planted area has been fenced with wire fencing.

The following trees are in Nurseries for future planting :—

Description.	South Block 1915 and 1916 trees.	South Block 1917 trees.	East Block 1915 trees from Kashmir.	East Block 1915 and 1916 trees.	Total.
1	2	3	4	5	6
Standard Apple trees ...	140	22	92	152	406
Bush " " ...	...	10	...	...	10
Standard Pear " ...	...	12	1	...	13
Sweet Chestnut ...	3	...	...	...	3
Pecan Nut	6	...	...	...	6

The establishment consists of an Overseer and a part time clerk each on a monthly salary of Rs. 25, 2 Khasi Apprentices, and 8 Khasi Malis on a monthly salary of Rs. 15 each. All have worked well and take great interest in their work.

4. *Varieties planted.*—The following statement shows the number and varieties of fruit trees planted :—

Species of fruit trees.	Variety.	Planted 1918-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	James Grieve ...	59	76	144	58	...	44	...	381	Bush.
	Boston Russet ...	...	2	12	...	...	...	...	14	
	Bens Red ...	...	...	10	10	...	9	...	29	
	Alfriston ...	...	...	29	...	...	8	...	37	
	Egremont Russet ...	10	...	...	8	1	...	...	19	
	Annie Elizabeth ...	...	...	20	...	...	...	...	20	
	Claygate Pearmain ...	8	...	...	10	...	...	...	18	
	Lord Hindlip ...	...	...	10	...	...	...	...	10	
	Mannington Pearmain	6	...	...	8	2	4	...	20	
	Winter Queening of Kent.	...	...	10	...	...	...	...	10	
	Pineapple Russet ...	...	...	...	9	...	...	...	9	
	Edward VII ...	...	...	8	...	...	...	...	8	
	Red Juneating ...	6	...	4	2	...	10	...	19	
	Flower of Kent ...	...	...	8	...	...	...	...	8	
	Cornish Pine ...	...	8	...	...	...	...	...	8	
	Tower of Glamis ...	...	...	...	...	6	...	...	6	
	Winter Banana ...	...	...	...	...	3	...	...	3	
	Wolf River ...	...	...	...	...	3	...	...	3	
	Chelmsford Wonder ...	...	...	...	...	6	...	...	6	
	Byford Wonder ...	...	...	...	...	10	...	...	10	
	Ruddy	...	...	...	...	6	...	...	6	
	Ormead Pearmain ...	...	...	...	...	6	...	...	6	
	Hambledon deux ans	...	...	...	...	5	...	...	5	
	Bellede Pontoise ...	...	...	...	...	5	...	...	5	
	Barnack Beauty ...	...	...	...	6	8	5	...	19	

Species of fruit trees.	Variety.	Planted 1913-19. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Lower garden.	South-west block.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10	11
Apple trees ...	Coronation ...	...	...	6	4	...	5	...	15	Bush.
	Wealthy ...	...	...	...	4	...	6	...	10	
	Feltham Beauty ...	...	...	10	...	...	...	...	10	
	Norfolk Beauty ...	8	33	...	10	...	10	...	61	
	Sansspariel ...	...	3	...	...	...	...	...	3	
	Guelph	...	1	...	...	...	...	...	1	
	Peacemaker ...	...	1	...	...	...	...	...	1	
	Roseberry ...	...	1	...	...	...	...	...	1	
	Christmas Pearmain...	...	...	10	...	...	...	...	10	
	Yorkshire Beauty ...	5	...	...	1	...	...	...	6	
	Kings Acre Pippin ...	...	...	5	...	...	...	...	5	
	Crimson Bramley ...	15	...	18	...	...	5	...	38	
	Royal Snow ...	...	...	10	...	...	...	...	10	
	Bramley's Seedling ...	15	...	15	...	...	14	...	44	
	Kings of Tompkins County.	1	...	8	2	...	...	...	11	
	Houblon	...	...	6	...	...	...	...	6	
	Roundway Magnum Bonum.	6	...	...	...	...	2	...	8	
	Wellington ...	...	...	5	...	...	...	...	5	
	Lane's Prince Albert	14	2	17	...	10	11	...	54	
	Upton Pyne ...	1	3	6	...	25	6	...	41	
	Devon Queen ...	4	1	2	...	2	...	...	9	
	Renown	...	4	...	...	6	...	...	10	
	Stirling Castle ...	10	...	10	...	...	...	...	20	
	Golden Russet ...	...	...	6	...	...	...	...	6	
	Charles Ross ...	10	...	10	...	11	...	...	31	
	Bismarck	...	1	17	8	...	19	...	45	
	Rymer	6	...	...	...	...	...	...	6	
	Warner's King ...	...	...	...	...	...	11	...	11	
	Thomas Rivers ...	10	...	...	...	...	...	...	10	
	Grenadier ...	...	2	14	...	...	3	...	19	
	Rev. W. Wilks ...	19	...	6	...	...	6	47	78	
	Hounslow Wonder ...	...	1	20	...	...	6	...	27	

Species of fruit trees.	Variety.	Planted 1913-19. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Lower garden.	South-west block.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Newton Wonder ...	15	...	21	...	...	16	...	52	Bush.
	Red Victoria ...	...	4	11	...	3	10	...	28	
	Potts' Seedling ...	4	...	5	...	...	10	...	19	
	Hector McDonald ...	...	...	20	...	...	10	...	30	
	Emperor Alexander ...	...	9	...	...	...	...	...	9	
	Sandringham ...	...	...	...	...	5	...	...	5	
	Rougemont ...	...	...	...	...	6	...	...	6	
	Hamblings Seedling...	...	...	...	...	6	...	...	6	
	Gabalva	...	...	...	...	6	...	...	6	
	Baron Wolsely ...	...	...	...	...	6	...	...	6	
	Loddington Seedling	...	...	...	...	6	...	...	6	
	Parroquet ...	...	...	...	...	6	...	...	6	
	Domino	13	...	...	...	...	...	...	13	
	Rival	...	...	16	...	12	...	...	28	
	Wadhurst Pippin ...	10	...	...	...	...	...	...	10	
	Court Pendu Plat ...	6	...	6	...	...	...	...	12	
	Ecklinville Seedling ...	4	...	4	...	...	...	...	8	
	Early Red Margaret ...	...	...	10	...	...	...	...	10	
	Gascoyne's Scarlet ...	4	...	5	...	...	...	...	9	
	Spitzenberg ...	...	...	6	...	...	...	...	6	
	Braddicks Nonpariel...	5	...	...	...	...	...	...	5	
	White Nonpariel ...	10	...	...	...	...	...	...	10	
	Baumann's Reinette...	6	7	8	...	4	...	...	25	
	Pitmaston Pineapple	10	...	...	...	...	...	...	10	
	Brownlee's Russet ...	10	...	...	...	...	...	...	10	
	Sturmer Pippin ...	5	6	16	...	...	20	...	47	
	Cardinal	...	...	9	1	...	...	...	10	
	Emneth Early ...	...	3	14	...	8	...	...	25	
	Langley Pippin ...	...	...	10	...	...	...	...	10	
	Wagener	...	...	9	...	...	...	...	9	
	Williams' Favourite...	10	...	...	...	...	...	...	10	
	Scarlet Nonpariel ...	...	...	10	...	...	12	...	22	

Species of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Lord Burghley ...	1	...	...	...	4	2	...	7	Bush.
	St. Everard ...	...	6	...	...	5	...	...	11	
	Beauty of Bedford ...	...	4	...	...	7	...	...	11	
	Reinette doree de Heusgen.	10	...	...	...	...	...	...	10	
	Coe's Golden Drop ...	...	...	...	...	...	6	...	6	
	Cox's Orange Pippin...	...	7	...	...	...	23	...	30	
	Kerry Pippin ...	...	10	16	...	...	10	...	36	
	Golden Reinette ...	...	...	...	...	...	6	...	6	
	Peasgood's Nonsuch...	...	...	25	...	...	14	...	39	
	Fearn's Pippin ...	...	...	12	...	...	6	...	18	
	Lady Sudeley ...	...	...	20	...	...	10	...	30	
	Devonshire Quarrenden	...	...	...	...	...	15	...	15	
	May Queen ...	...	10	...	...	...	...	...	10	
	Royal Jubilee ...	...	10	...	...	...	...	...	10	
	Missing Link ...	...	1	...	...	...	...	...	1	
	Roseberry ...	...	1	...	...	...	...	...	1	
	Crawley Beauty ...	...	1	...	...	...	...	...	1	
	Mrs. Phillimore ...	...	...	...	...	6	...	...	6	
	Lord Grosvenor ...	...	...	...	...	6	...	...	6	
	Blue Pearmain ...	...	...	...	...	4	...	...	4	
	Jefferson ...	...	...	...	...	7	...	...	7	
	Star of Devon ...	...	...	...	...	20	6	...	26	
	Yellow Ingestre ...	...	...	...	...	...	6	...	6	
	Ardcairn Russet ...	...	7	5	1	11	5	...	29	
	Allington Pippin ...	...	16	5	...	...	4	...	25	
	William Crump ...	...	10	10	...	9	6	...	44	
	Worcester Pearmain...	...	...	...	...	...	6	...	6	
	Herring's Pippin ...	4	6	3	...	52	1	...	66	
	Beauty of Bath ...	...	5	5	...	...	1	...	11	
	Ellison Orange ...	...	...	...	...	16	1	...	17	
	Ribston Pippin ...	...	4	...	...	...	6	...	10	
	Charles Eyre ...	...	...	3	...	9	7	...	19	

Species of fruit trees.	Variety.	Planted 1918-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
	Cyke House Russet ...	...	...	...	...	...	6	...	6	Bush.
	Spring Ribston Pippin	...	...	8	...	...	...	...	8	
	Mr. Gladstone ...	...	...	6	...	...	5	...	11	
	Golden Spire ...	...	14	...	...	9	...	...	23	
	Rosemary Russet ...	...	...	6	...	...	6	...	12	
	Duke of Devonshire ...	...	6	...	...	...	...	...	6	
	Early Peach ...	...	10	...	...	...	...	...	10	
	Newtown Pippin ...	...	2	8	...	...	6	...	6	
	American Mother ...	...	9	...	...	...	...	...	9	
	Encore	...	...	18	...		4	...	22	
	Irish Peach ...	...	6	...	...	...	...	...	6	
	Lord Stradbroke ...	...	...	...	...	6	...	...	6	
	Total ...	340	313	702	142	354	430	47	2,418	
Apple trees ...	Encore	...	6	...	...	...	...	5	11	Standards.
	Crimson Bramley ...	...	5	3	10	...	...	...	18	
	Rymer	...	...	...	...	...	8	...	8	
	Bramley's Seedling ...	...	...	8	12	...	...	...	20	
	Court of Wick ...	...	...	6	...	...	...	...	6	
	Irish Peach ...	...	...	...	6	...	...	...	6	
	Northern Greening ...	...	...	...	...	...	7	1	8	
	Norfolk Beefing ...	...	...	...	6	...	...	...	6	
	Newton Wonder ...	...	4	21	...	...	...	...	25	
	Stirling Castle ...	...	...	5	1	...	2	3	11	
	Allington Pippin ...	...	...	...	...	...	...	...	...	
	Annie Elizabeth ...	...	...	...	...	9	...	1	10	
	Ellison's Orange ...	...	...	...	...	6	...	4	10	
	Chelmsford Wonder ...	...	...	...	...	6	...	...	6	
	LordG rosvenor ...	...	...	...	...	7	...	2	9	
	Christmas Pearmain...	...	...	...	...	10	...	...	10	
	Baldwin	...		...	...	...	6	3	[19	

Species of fruit trees.	Variety.	Planted 1913-19.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees ...	Beauty of Kent ...	...	...	...	...	...	...	6	6	Standards.
	Duchess of Oldenburg	...	...	6	...	...	...	...	6	
	Norfolk Bearer ...	...	...	5	1	...	...	...	6	
	King of Tompkins County.	...	...	6	...	...	...	...	6	
	Emperor Alexander ...	...	...	...	6	...	...	...	6	
	James Grieve ...	...	3	17	...	...	...	...	20	
	Cox's Pomona ...	...	...	2	4	...	...	...	6	
	Small's Admirable ...	...	...	6	...	...	...	...	6	
	New Hawthorden ...	...	...	4	...	...	...	...	4	
	Calville St. Saumur ...	...	7	...	...	...	8	...	15	
	Reinette de Cezy ...	...	8	...	...	...	5	...	13	
	Precoce David ...	...	3	...	...	...	2	...	5	
	Kashmir Amroo ...	...	3	...	...	...	...	...	3	
	Fenoillet Gris ...	...	4	...	...	...	4	5	13	
	Api Petit	1	4	1	...	...	2	...	8	
	Delicious (Starks) ...	...	50	12	...	...	...	...	62	
	King David ...	...	26	13	...	...	...	36	75	
	York Imperial ...	...	...	6	...	...	...	...	6	
	Paragon Winesap (Starks).	...	...	5	...	...	...	...	5	
	Jonathan (Starks) ...	...	2	6	...	...	...	...	8	
	Black Ben (,,) ...	...	20	5	...	...	...	35	60	
	Stayman Winesap (Starks).	...	...	6	...	...	...	18	24	
	Senator (Starks) ...	...	1	4	...	...	...	...	5	
	Grimes Golden (Starks)	...	12	5	...	...	...	12	29	
	Summer Champion (Starks).	...	2	...	...	...	...	...	2	
	Mother (Starks) ...	...	...	6	...	...	...	...	6	
	Emneth Early ...	...	...	10	...	...	...	...	10	
	Baumann's Reinette...	...	...	10	...	...	...	...	10	
	Grenadier	...	...	8	...	...	...	...	8	
	Cox's Orange Pippin...	...	...	15	...	...	...	...	15	

Special of fruit trees.	Variety.	Planted 1913-19. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Lower garden.	South-west block.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10	11
Apple trees ...	Red Victoria ...	...	...	...	...	...	...	5	5	Standards.
	Blenheim Orange ...	...	3	8	...	...	...	...	11	
	Calville Blanc ...	...	...	6	...	...	...	...	6	
	Norfolk Beauty ...	...	15	14	1	...	...	...	30	
	Reinette du Canada...	...	6	4	...	...	2	3	15	
	Winter Greening ...	...	8	...	...	...	...	...	8	
	Rev. W. Wilks ...	...	1	...	...	29	6	3	39	
	Lord Burghley ...	...	6	...	...	...	...	...	6	
	Lady Henniker ...	...	4	6	...	...	...	...	10	
	Golden Spire ...	...	4	4	...	...	...	...	8	
	Bismarck	...	4	6	...	...	...	...	10	
	Calville Rouge d'hiver	...	6	...	...	1	14	10	31	
	Charles Ross ...	...	3	2	...	4	...	6	15	
	Lord Derby ...	...	...	...	...	...	...	8	8	
	Barnack Beauty ...	...	...	1	...	6	3	4	14	
	Herrings Pippin ...	...	3	...	...	16	...	...	19	
	Rival	...	2	...	...	6	...	7	15	
	Star of Devon ...	...	...	...	...	4	...	2	6	
	William Crump ...	...	...	...	...	5	...	...	5	
	Upton Pyne ...	...	...	...	...	15	...	5	20	
	Early Melon (Starks)...	...	...	4	...	...	...	...	4	
	Wealthy („)...	...	...	4	...	...	...	...	4	
	Wilson's Red June (Starks).	...	...	6	...	...	...	...	6	
	Liveland Raspberry (Starks).	...	...	6	...	...	...	...	6	
	Worcester Pearmain...	...	...	...	...	...	...	...	...	
	Tower of Glamis ...	...	...	...	...	...	...	6	6	
	Total ...	1	230	272	47	124	77	195	946	
	Blenheim Orange ...	...	...	1	11	...	...	...	12	Horizontal trained.
	James Grieve ...	...	...	...	...	...	4	...	4	
	Feltham Beauty ...	...	...	2	3	...	...	...	5	
	Lady Sudeley ...	2	...	...	...	...	3	...	5	
	Herring's Pippin ...	...	...	3	1	...	2	...	5	

Species of fruit trees.	Variety.	Planted 1913-19. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Gascoyne's Scarlet ...	3	...	...	...	...	...	3	Horizontal trained.
	Charles Ross ...	3	...	...	...	...	...	3	
	Brownlees Russet ...	3	...	...	...	...	2	5	
	Baumann's Reinette...	3	...	...	...	...	...	3	
	Beauty of Bath ...	...	...	...	...	...	5	5	
	Sturmer Pippin ...	6	...	...	...	...	...	6	
	Cox's Orange Pippin...	...	...	...	...	...	1	1	
	Cox's Pomona ...	1	...	...	...	...	3	4	
	King of the Pippins ...	...	...	3	...	...	2	5	
	Kerry Pippin ...	...	...	...	...	...	1	1	
	Claygate Pearmain ...	...	...	...	...	...	1	1	
	King of Tompkins County.	...	...	3	...	...	...	3	
	Sterling Castle ...	...	...	...	...	...	3	3	
	Total ...	21	...	11	15	...	27	74	
	Sturmer Pippin ...	...	...	...	3	...	...	3	Upright trained
	Mannington Pearmain	...	...	...	3	...	...	3	
	Scarlet Golden Pippin	...	...	...	...	...	2	2	
	Washington ...	2	...	2	2	...	...	6	
	Allington Pippin ...	...	...	...	...	...	2	2	
	Golden Spire ...	...	...	1	...	...	...	1	
	Beauty of Bath ...	...	...	...	...	...	2	2	
	Adams Pearmain ...	2	...	...	1	...	...	3	
	James Grieve ...	...	...	...	...	...	2	2	
	King of the Pippins...	...	...	2	1	...	...	3	
	Barnack Beauty ...	...	...	...	...	...	2	2	
	King of Tompkins County.	...	...	...	5	...	...	5	
	Total ...	4	...	5	15	...	10	34	

Species of fruit trees.	Variety.	Planted 1913-19. Upper garden. Top block.	South block.	East block.	North block.	East extension.	Lower garden.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Charles Ross ...	...	...	6	...	...	...	6	Palmette Verrier trained.
	Rival	...	...	5	...	...	...	5	
	James Grieve ...	...	...	6	...	...	...	6	
	Blenheim Orange ...	...	...	6	...	...	...	6	
	Total ...	...	...	23	...	...	...	23	
	Baumann's Reinette...	...	4	...	...	...	...	4	Fan trained.
	Golden Spire ...	...	1	...	...	...	...	1	
	Total ...	...	5	...	...	...	...	5	
	Rival	...	...	3	...	...	...	3	Double Cordon.
	Total ...	...	...	3	...	...	...	3	
	Rival	...	...	3	...	...	...	3	Single Cordon.
	Total ...	...	...	3	...	...	...	3	

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Fertility	..	53	1	...	18	72	Bush and Pyramid.
	St. Swithins ...	...	...	...	...	10	10	
	Beurre Hardy ...	...	17	1	...	2	20	
	Red October ...	...	...	...	...	8	8	
	Beurre d'Anjou ...	...	6	...	...	...	6	
	Parrot	...	...	...	...	10	10	
	William's Bon Chretien.	...	13	...	...	...	13	
	Seedling Bergamot ...	...	...	...	...	6	6	
	Fondante Thirriot ...	...	10	...	...	10	20	
	Dr. Hogg	...	...	...	...	7	7	
	Triomphe de Vienne ...	...	6	...	...	...	6	
	Beacon	...	...	4	...	6	10	
	Beurre de Naghan ...	...	...	...	...	6	6	
	Charles Ernest ...	...	12	...	...	...	12	
	Roosevelt	...	...	...	...	6	6	
	Doyenne d'Ete ...	...	10	...	...	...	10	
	Blickling	...	...	...	...	6	6	
	Ganscls Bergamot ...	...	6	...	...	...	6	
	Santa Claus ...	...	...	...	...	6	16	
	Josephine de Malines...	...	6	...	...	9	15	
	Precoce de Juillet ...	...	...	...	...	5	5	
	Dr. Jules Guyot ...	...	11	...	...	6	17	
	Madame Treyve ...	...	...	...	...	10	10	
	Durondeau ...	...	7	1	...	2	10	
	Hessle	...	5	...	...	14	19	
	Beurre d'Amanlis ...	...	12	...	...	10	22	
	Emile d'Heyst ...	...	5	...	...	10	15	
	Marie Benoist ...	...	6	...	...	...	6	
	Clapp's Favourite ...	...	5	...	...	10	15	
	Louise Bonne of Jersey	...	2	...	...	...	2	
	President Barabe ...	...	5	...	...	...	5	
	Thompson ...	...	5	...	...	...	5	
	Winter Nelis ...	...	4	...	...	...	4	
	Marguerite Marillat ...	...	6	...	...	...	6	
	Seckle	...	...	6	...	...	6	
	Beurre Fouqueray ...	...	...	6	...	...		

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Directeur Hardy ...	...	...	5	...	...	5	Bush and Pyramid.
	Colmar d'Ete ...	...	6	6	...	...	12	
	Princess	...	6	6	...	...	12	
	Belle Julie ...	...	6	6	...	...	12	
	Doyenne du Comice ...	...	1	4	...	...	5	
	Total ...	...	231	46	...	177	454	
	Beurre Hardy ...	...	13	...	...	5	18	Single Cordon.
	Clapp's Favourite ...	...	10	...	...	...	10	
	Durondeau ...	...	9	...	...	...	9	
	Madame Treyve ...	...	10	5	...	...	15	
	William's Bon Chretien	...	7	...	...	5	12	
	Marguerite Marillat...	...	14	...	...	5	19	
	Doyenne du Comice ...	...	10	...	...	5	15	
	Fondante Thirriot ...	...	...	5	...	...	5	
	Louise Bonne of Jersey	...	10	...	...	2	12	
	Conference ...	...	9	...	...	5	14	
	Emile d'Heyst ...	...	9	...	...	...	9	
	Winter Nelis ...	...	5	...	...	...	5	
	Fondante d'Automme	...	...	5	...	...	5	
	Beurre Superfin ...	...	...	...	...	5	5	
	Princess	...	...	5	...	5	10	
	Beurre Fouqueray ...	...	...	5	...	...	5	
	Beurre Diel ...	...	...	...	...	5	5	
	Directeur Hardy ...	...	...	5	...	...	5	
	Beurre d' Anjou ...	...	...	...	...	5	5	
	Colmar d'Ete ...	...	...	5	...	...	5	
	Total ...	...	106	35	...	47	188	
	Directeur Hardy ...	...	5	5	...	...	10	Horizontal trained.
	Duchess d'Angouleme	...	1	...	...	...	1	
	Clapp's Favourite ...	...	2	...	...	...	2	
	Josephine de Malines...	...	1	...	...	...	1	
	Emile d'Heyst ...	...	2	...	...	...	2	
	Louise Bonne of Jersey	...	1	...	...	...	1	

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
	Beurre Superfin ...	...	1	...	...	...	1	Horizontal trained.
	Princess ...	...	6	...	...	...	6	
	Conference ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	2	...	...	...	2	
	Durondeau ...	...	1	...	...	...	1	
	Pitmaston Duchess ...	...	1	...	...	...	1	
	Fondante d'Automne...	...	1	...	...	...	1	
	Doyenne du Comice ...	...	2	...	...	...	2	
	Winter Nelis ...	4	...	...	...	...	4	
	Marguerite Marillat ...	...	5	...	...	...	5	
	Total ...	4	33	5	...	...	42	
Pear trees	Kashmir	...	...	...	38	...	38	Standards.
	Marquerite Marillat ...	...	...	6	...	...	6	
	King Karl (Starks) ...	...	1	...	3	1	5	
	Anjou (,,) ...	...	3	...	4	1	8	
	Lincoln (,,) ...	...	3	...	5	...	8	
	Howell (,,) ...	...	6	...	3	...	9	
	Duchess (,,) ...	...	3	...	1	1	5	
	Bartlett (,,) ...	...	8	...	4	1	13	
	Seckle (,,) ...	...	4	...	...	4	8	
	Marie Louise ...	...	2	...	...	...	2	
	Dr. Jules Guyot ...	...	5	11	...	...	16	
	Conference ...	...	2	...	...	...	2	
	Emile d'Heyst ...	...	3	...	...	...	3	
	Madame Treyve ...	...	8	...	...	...	8	
	Count de Lamy ...	...	3	...	...	...	3	
	Louise Bonne of Jersey	...	2	...	...	...	2	
	Beurre Capiaumont ...	...	6	...	...	...	6	
	Princess	...	2	...	...	...	2	
	Doyenne du Comice ...	...	2	...	...	...	2	
	William's Bon Chretien	...	2	...	...	...	2	
	Souvenr du Congress...	...	...	...	...	...	2	
	Marie-Louise d'Uccle...	...	...	...	...	...	2	
	Fertility	...	28	...	3	...	...	

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Seckle	...	...	2	...	...	2	Standards.
	Bartlett Hybrid (Starks)	...	...	...	5	...	5	
	Fame (,,)	...	...	...	...	4	4	
	Reihl Best (,,)	...	...	...	4	2	6	
	Boussock (,,)	...	...	...	3	2	5	
	Triumph (,,)	...	...	...	4	...	4	
	Winter Bartlett (,,)	...	...	...	...	7	7	
	Comice (,,)	...	...	...	...	4	4	
	Total ...	...	97	24	77	27	225	
	Princess	...	4	...	...	...	4	Upright trained.
	Conference ...	...	...	...	...	3	3	
	Madame Treyve ...	...	...	5	...	...	5	
	Marie Louise d' Uccle	...	...	...	...	4	4	
	Louise Bonne of Jersey	...	...	...	...	4	4	
	Beurre Hardy ...	5	...	...	...	...	5	
	Fondante d' Automne	...	...	...	...	3	3	
	Winter Nelis ...	...	...	...	4	...	4	
	Conseiller de la Cour...	...	...	...	...	3	3	
	Doyenne du Comice ...	...	...	...	...	3	3	
	Marguerite Marillat...	4	1	...	...	...	5	
	Total ...	9	5	5	4	20	43	

Species of fruit trees.	Variety.	Planted 1913-19.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Late Transparent ...	...	...	...	...	6	...	6	Bush.
	Guthrees Late Gage ...	...	4	...	...	...	...	4	
	Deniston's Superb Gage.	...	3	...	...	10	...	13	
	White Botan ...	...	1	...	...	...	2	3	
	Satsuma	...	2	...	...	1	3	6	
	Burbank	...	2	...	...	...	1	3	
	Prosperity... ...	...	5	...	...	...	...	5	
	Reine Claudede Bavay	...	3	...	...	...	...	3	
	Belle de Louvain ...	...	...	...	...	6	...	6	
	Curlew	...	5	...	...	...	...	5	
	Utility	...	2	...	...	...	1	3	
	Greengage... ...	...	1	...	...	5	...	6	
	Coxs Emperor ...	...	4	...	...	...	...	4	
	Heron	...	5	...	...	...	...	5	
	Mitchelsons ...	...	8	...	...	...	...	8	
	Monarch	...	...	3	...	...	...	3	
	Ickworth	...	2	...	...	...	...	2	
	Stark's Gold ...	3	...	...	...	...	...	3	
	Diamond	...	3	...	...	...	...	3	
	Belgian Purple ...	...	1	...	...	10	...	11	
	Bittern	...	5	...	...	...	...	5	
	Rutland Plumcot ...	1	...	...	...	...	...	1	
	Primate	...	5	...	...	...	...	5	
	Pond's Seedling ...	...	7	...	...	3	...	10	
	Admiral	...	5	...	...	...	...	5	
	Stark's Shiro ...	1	...	...	...	...	...	1	
	President... ...	...	6	...	...	...	...	6	
	Stark's Omaha ...	...	...	1	...	1	...	2	
	Jefferson	...	3	...	...	...	...	3	
	Autumn Beauty ...	...	...	1	...	...	...	1	
	Wyedale	...	3	...	...	...	...	3	
	King of the Damsons...	...	...	...	...	2	...	2	
	Kirks Blue ...	...	3	...	...	...	...	3	

Species of fruit trees.	Variety.	Planted 1913-10.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Plum trees ...	Shepherd's Bullace ...	...	...	...	...	3	...	3	Bush.
	Czar	...	6	...	...	...	...	6	
	Langley's Bullace ...	...	...	...	...	3	...	3	
	Victoria	...	6	...	...	...	...	6	
	White Damson ...	...	...	...	...	3	...	3	
	Prince Englebert ...	...	3	...	...	...	...	3	
	Prune Shropshire ...	...	...	...	...	3	...	3	
	Kashmir Greengage ...	...	4	...	...	...	...	4	
	Merryweather Damson	...	...	...	...	10	...	10	
	Count d'Althan gage...	...	1	...	...	...	...	1	
	Stark's America ...	...	...	2	...	...	...	2	
	Stint	...	1	...	...	...	...	1	
	Burbanks Giant Prune	...	8	...	...	4	...	12	
	Yellow Pershore ...	...	...	...	...	1	..	1	
	Total ...	5	116	7	...	71	7	206	
	Decaise	...	...	...	...	1	...	1	Fan trained.
	Kirkes	...	...	...	...	2	...	2	
	Jefferson	...	...	...	...	2	...	2	
	Mallard	...	...	...	...	1	...	1	
	Golden Esperen ...	...	...	...	...	1	...	1	
	Oullin's Golden Gage ..	...	...	...	...	2	...	2	
	Reine Claude d' Althan.	...	...	...	...	1	...	1	
	Early Transparent	...	...	...	...	1	...	1	
	Coe's Golden Drop ...	...	...	...	...	1	...	1	
	Transparent Gage ...	...	...	...	...	1	...	1	
	Greengage ...	...	...	...	...	2	...	2	
	Golden Transparent Gage.	...	...	...	...	1	...	1	
	Belgian Purple ...	...	...	...	...	1	...	1	
	Total ...	...	...	...	...	17	...	17	

Species of fruit trees.	Variety.	Planted 1913-19. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	South-west block.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Cherry trees ...	Morello	...	16	...	3	3	...	22	Trees.
	Kentish	...	12	...	...	16	...	28	
	Bigarreau Kentish ...	...	...	...	...	3	...	3	
	Gloire de France ...	...	1	...	...	2	...	3	
	White Heart ...	...	...	...	...	4	...	4	
	Black Heart	...	...	...	...	5	...	5	
	Kashmir	...	24	...	...	7	...	31	
	Montmorency King ...	...	2	...	...	1	...	3	
	Burbank	...	4	...	...	1	...	5	
	Total ...	...	59	...	3	42	...	104	
	Turkey Black Heart ...	...	...	...	...	1	...	1	Fan trained.
	Late Black Bigarreau...	...	...	...	...	1	...	1	
	Frogmore Bigarreau...	...	...	...	...	1	...	1	
	Noir de Guben ...	...	...	...	...	1	...	1	
	Belle de St. Trone ...	...	...	...	...	1	...	1	
	Early Rivers ...	...	...	...	...	1	...	1	
	Total ...	...	...	...	...	6	...	6	
Orange trees ...	Japanese Satsuma ...	...	1	...	...	1	...	2	Trees.
	Japanese Kumquot ...	...	8	...	...	4	...	12	
	Malta Blood ...	...	14	...	...	2	...	16	
	St. Michæl's ...	...	13	...	...	1	...	14	
	Jaffa	...	2	...	...	1	...	3	
	Malta Oval ...	...	2	...	...	1	...	3	
	Silver	...	3	...	...	1	...	4	
	Excelsior	...	1	...	...	1	...	2	
	St. Michæl's Tangierin.	...	1	...	...	5	...	6	
	St. Michæl's Dom Louise.	...	1	...	...	2	...	3	
	St. Michæl's Sustain...	...	1	...	...	1	...	2	
	Ditto Achilles	...	...	...	...	1	...	1	
	Total ...	...	47	...	...	21	...	68	

Species of fruit trees.	Variety.	Planted 1913-19. Upper garden. Top block.	South block.	East block.	North block.	Lower garden.	South-west block.	Total number.	Description.
1	2	3	4	5	6	7	8	9	10
Lime and Lemon trees.	Kazla Lime ...	...	1	2	...	...	...	3	
	Imperial Lemon ...	...	...	...	...	2	...	2	
	Gora Lime ...	...	2	1	...	...	...	3	
	Bijou Lemon ...	...	...	...	...	4	...	4	
	Kagzi Lime ...	...	4	...	...	...	...	4	
	Total ...	...	7	3	...	6	...	16	
Walnut trees ...	Dwarf Prolific ...	...	7	...	...	...	10	17	
	Kashmir	...	6	2	...	...	...	8	
	Total ...	...	13	2	...	...	10	25	Trees.
Peach trees ...	Princess of Wales ...	...	...	...	3	...	...	3	
	Peregrine	...	...	...	...	3	11	14	
	Alexander	...	...	...	...	3	10	13	
	Duke of York ...	...	...	...	...	1	16	17	
	Exquisite	...	...	...	...	...	2	2	
	Late Devonian ...	...	...	...	...	2	...	2	
	Lady Palmerston ...	...	...	...	...	2	...	2	
	Kestrel	...	...	...	...	6	...	6	
	Hales Early ...	...	...	...	...	3	...	3	
	Total ...	...	...	...	3	20	39	62	
Apricot trees ...	Superb (Starks) ...	...	...	...	...	1	...	1	
	Blenheim	...	...	...	...	6	...	6	Trees.
	Kashmir	...	7	...	...	...	...	7	
	Total ...	...	7	...	...	7	...	14	

Species of fruit trees.	Variety.	Planted 1913-10.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Quince trees	Meeks Prolific ...	...	1	...	...	1	...	2	Trees.
	Champion... ...	...	1	...	...	...	...	1	
	Portugal	...	1	...	...	1	...	2	
	Total ...	...	3	...	...	2	...	5	
Almond trees	Hill Almond ...	...	12	...	...	...	...	12	
	Total ...	...	12	...	...	...	...	12	

Species of fruit t ees.	Variety.	Planted 1913-19.						Description.
		Upper garden.			Lower garden.	South-west block.	Total number.	
		South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9
Wineberry	...	...	...	...	6	...	6	Berries.
King's Acre Berry ...	.....	...	...	...	5	...	5	
Logunberry ...	.....	...	...	...	3	...	3	
Phonomenal ...	.....	...	...	...	3	...	3	
Laxtonberry ...	.....	...	...	...	3	...	3	
Blackberry... ...	Blowers	...	...	...	100	...	100	
Ditto	Pyne's Giant Himalaya Berry of California.	...	...	...	100	...	100	
	Total ...	...	...	...	220	...	220	
Strawberry ...	Givon's late Prolific...	...	...	...	900	...	900	Plants.
	Louis Gauthier ...	...	500	...	350	...	850	
	Royal Sovereign ...	3,000	3,000	...	1,250	...	7,250	
	Total ...	3,000	3,500	...	2,500	...	9,000	
Currant	Boskoop Giant Black...	...	2	...	...	...	2	Bushes.
	Blacksmith ...	11	...	...	...	...	11	
	Defender Black ...	...	1	...	...	...	1	
	Victoria Black ...	5	...	...	...	...	5	
	Southwell's Black ...	...	20	...	...	...	20	
	White La Versaille ...	4	...	...	...	...	4	
	Total ...	20	23	...	24	...	47	
Nut trees ...	White Filbert ...	...	...	...	2	...	2	Trees.
	Red Filbert ...	...	...	...	3	...	3	
	Prize Cob	...	...	...	3	...	3	
	Kentish Cob ...	...	...	...	3	...	3	
	Total ...	...	...	...	11	...	11	

Species of fruit trees.	Variety.	Planted 1913-19.					Total number.	Description.
		Upper garden.			Lower garden.	South-west block.		
		South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9
Grape Vines ...	Campbell's Early (Starks).	...	2	...	...	...	2	Vines.
	Hicks (Starks) ...	...	3	...	...	...	3	
	King („) ...	...	2	...	...	...	2	
	Eclipse („) ...	...	1	...	...	...	1	
	King Philip („) ...	...	2	...	...	...	2	
	Wilder („) ...	...	2	...	...	...	2	
	Worden („) ...	...	2	...	...	...	2	
	Niagara („) ...	...	2	...	...	...	2	
	Total ...	...	16	...	...	...	16	

Summary of Fruit Trees planted to 31st March 1919.

	Total.
1	2
Bush Apple trees	2,418
Standard „ „	946
Horizontal trained Apple trees	74
Upright „ „ „	34
Palmette Verrier „ „ „	23
Fan „ „ „	5
Double Cordon „ „ „	3
Single „ „ „ „	3
Bush and Pyramid Pear „	454
Single Cordon „ „	188
Horizontal trained „ „	37
Standard „ „	225
Upright trained „ „	43
Bush Plum trees	206
Fan trained Plum trees	17
Cherry standard trees	104
Cherry fan trained trees	6
Orange trees	68
Lemon „	16
Walnut „	25
Peach „	62
Apricot „	14
Quince „	5
Almond „	12
Wineberry	6
King's Acreberry	5

	Total.
1	2
Loganberry	3
Phenomenal Berry	3
Laxtonberry	3
Blower's Blackberry	100
Giant Himalaya Blackberry	100
Strawberry plants	9,000
Currant Bushes	43
Nut	11
Grape Vines	16

Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st July 1918 to 31st March 1919.

Receipts.	Amount.			Expenditure.	Amount.		
1	2			3	4		
	Rs.	a.	p.		Rs.	a.	p.
Sale-proceeds of Apples ...	719	8	0	Allowance to Superintendent	3,000	0	0
„ of Pears ...	26	0	0	Establishment ...	1,755	0	0
„ of Peaches...	15	0	0	Petty construction ...	491	12	3
„ of Strawberries.	15	0	0	Seeds, Plants and Manures	135	5	0
„ of Damsons...	5	0	0	Instruments, Appliances, Apparatus and Machinery.	88	0	0
				Wages of labourers ...	4,858	8	6
				Service postage ...	30	0	0
				Other charges ...	519	2	0
Total Receipts ...	780	8	0	Total Expenditure ...	10,877	11	9

C. H. HOLDER,

In charge, Fruit Experiment Station, Shillong.

The 15th May 1919.

REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR NINE MONTHS ENDING THE 31ST MARCH 1919.

General.

This station was established in January 1914. It is situated on the Sylhet Road, 3½ miles to the west of the subdivisional station of Karimganj, which lies on the Assam-Bengal Railway.

The total area of the farm is a little under 80 acres. Leaving out a compact block of 8 acres which has been set apart for the farmstead and quarters for the staff, and the area covered by roads and drains estimated at 4 acres, the net area available for cultivation is about 68 acres.

The station is devoted mainly to experimental work on rice and jute.

Character of land and soil.

2. The farm lies close to the Langai river which occasionally rises in high flood and lays the country all round under water. This liability to floods is characteristic of the rice lands in the locality.

The soil of the greater portion of the farm is a deep alluvial clay of fine texture, though not particularly heavy. In the higher lands, it is somewhat lighter in character and may be described as a medium loam.

A representative sample of the soil of the farm has recently been sent for analysis to the Agricultural Chemist to the Assam Administration and the results are being awaited with interest.

Equipment.

3. No changes were made in equipment during the year although several much needed works have been kept pending owing to the impossibility of procuring materials unless at exhorbitant rates. The godown space on the farm is now proving quite inadequate, and arrangements are being made to increase it soon. It is also proposed to erect permanent quarters, instead of the temporary building which has been used to accommodate some of the farm apprentices during the last two years. In the past cold weather about one lakh of bricks has been prepared so that some of this work may be started at the earliest possible date.

The number of working cattle now stands at 28 compared with 32 last year. Two bullocks were transferred to the Upper Shillong Farm, four old bullocks were sold, and four younger ones bought to replace them.

With the object of acclimatizing the Shillong bulls in the plains, three more have been brought down making, with the stud bull brought in the present year, four now on the farm. The cost of feeding will be much less than at Shillong. The animals will be given light work and when they have become acclimatized and have shown signs of activity they will be sold off for breeding purposes. This of course will necessitate increased expenditure under the budget head "Feed of cattle" for which provision will have to be made.

Character of the year.

4. The official agricultural year was found extremely inconvenient for the purpose of report, as it covered the latter half of one *kharif* season, the first half of the *kharif* season following, and the *rabi* season intervening. In consequence the Local Administration was moved to allow a change to be made in the agricultural year so that it should correspond with the financial year and end on 31st March. This has now been done and the present report deals with the period from July 1st, 1918, to 31st March 1919. The following table shows the rainfall during each month of this period:—

—	Actual.	Normal.
1	2	3
July 1918	44·11	23·11
August „	21·37	22 83
September „	19·86	18·58
October „	3·98	8·31
November „	...	1·31
December „	·11	0 56
January 1919	·18	0·75
February „	·43	1·46
March „	·52	8·80
Total ...	90·56	85·71

Heavy and continuous rainfall in July caused floods in the district and injured the crops. Part of the *asra* and *sail* crops on the farm were destroyed but there was still sufficient time to replant and, as plenty of seedlings were available, this was done as soon as the fall of water permitted. Although some injury was caused by the continuous high floods having delayed replanting, on the whole the yields were good.

The total rainfall from the 17th October 1918 to the 31st March 1919 was only one and a quarter inches; as a result *rabi* crops were again almost a complete failure.

Rice breeding.

5. As befits a station situated in such an extensive rice-growing district as the Surma Valley, attention is devoted mainly to effecting improvements in this staple.

Rice-breeding experiments were arranged in 1914, after a consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Rai Bahadur B. C. Basu, Special Officer for Agriculture, and Mr. G. P. Hector, Economic Botanist, Bengal. These experiments have been carried on since.

An account of the methods adopted, together with the various modifications which circumstances have since rendered necessary, will be found in the previous annual reports. The selection work is now being restricted to early broadcast *Aus* and transplanted winter rice. The latter known by the general name of *sail* forms the most important class of rice grown in the province.

In the past two years a number of types of both *aus* and *sail* has been discarded as unsuitable; the remaining types were retained as having one or more good qualities to recommend them. With the object of selecting one or two of the heaviest yielding types of each class the following method is now being adopted for this season's work. A few of the types in each class which have shown specially good qualities will be selected for a thorough and final test. In this test one good type will be taken as a standard, and each of the other types will be grown alongside the standard type twenty five times. Small plots will of necessity be used; each one will consist of 14 lines of 14 plants or 196 plants in all. By repeating the tests in this way, accidental differences due to soil or water level will be eliminated and the average of the yields obtained should be a reliable indication of the cropping powers of each type tested.

Fifty-six types of early broadcast *aus* are now being dealt with. These have been grown side by side since the work was started, and from a comparison of their cropping and other

qualities have now been divided into two lots. One lot contains ten types and resembles the Dumai sub-class, which is one of the quickest maturing classes of rice known. The other lot contains 46 types and resembles the Murali sub-class. Three types have been selected from among the first lot, and six from the second lot, as showing heavier yields than the remainder from the averages obtained in the past three years. These will be tested in the coming season according to the abovementioned method. At the same time all our *aus* varieties, 56 in number, will be kept under observation in the present season by growing a further generation of pure line seed in standard plots of 196 plants.

From the *sail* types which we have tried up to date, a total of 109 was grown in a single series of standard plots in the past year. The Economic Botanist, Bengal, who visited the farm in November last, assisted in doing a certain amount of selection work. On his recommendation 18 types were discarded, and four of what seemed the best types were selected for thorough and final test against *Indra sail* as a standard.

In addition to the above tests the remaining 91 varieties and 28 varieties recently selected and sent in from the districts by the Agricultural Inspectors will be grown as single series for further observation.

This selection work has now reached the stage when its bearing on the agricultural work in the district becomes evident.

From the present time, selected types will be tested in areas outside the farm by the local agricultural officer, and the results obtained by these officers will be utilized in arranging the details of future work.

Indra sail and George *sail* have generally given good results where tried throughout the province.

In the present season each Agricultural Inspector has arranged for the distribution of numerous small lots of five seers each to interested cultivators in his district. The object is to introduce these selections to cultivators over as wide an area as possible.

The seed is being given free on the understanding that a similar quantity will be returned from the produce. Where the introduced kinds prove obviously superior to local paddies, distribution will be pushed forward vigorously in the following year. If, on the other hand, the local kind proves obviously superior a representative sample will be brought to the farm for inclusion in the observation tests of the following year.

Intra-varietal selection experiment.

There appears to be a difference of opinion among Botanists as to the extent to which it may be possible to improve the productivity of a variety by selecting heavy yielding single plants from that variety.

In order that some information might be gained on this point the above experiment was begun in the year 1917. *Lati sail* as one of the heaviest yielding local varieties was selected for the trial, and seedlings were transplanted in $\frac{1}{10}$th of an acre. At harvest time 100 plants having the same characters as the original variety were selected at random and kept separately. All the well-formed grains of the ears of each single plant were afterwards counted, and the number of grains was found to vary from 232 to 1,140. The seeds of five of the heaviest yielding plants were tested against five of the least productive, each being grown separately and as a pure line type. The result of the trial was that one hundred plants, grown from seed of the plant which produced 1,140 grains, gave a yield of 146 tolas. While one hundred plants grown from the seed of the plant which produced 232 grains gave a yield of 214 tolas.

The result, if somewhat unexpected, is interesting. However the pressure of other work will prevent further trials of the kind from being carried out.

Minor experiment.

6. The experiments carried out on a small scale included the following :—

(1) *Bonemeal as manure for double crop rice land* versus *no manure.*—This experiment which was begun in 1915 was designed to give some information, firstly, as to whether or not bonemeal-manuring will prove profitable on the Karimganj Farm or similar rice lands, and, secondly, as to the quantity of bonemeal which should be applied.

Bonemeal has been used at three different rates, *viz.* :—

(*a*) At 3 maunds—247 pounds per acre applied in alternate years with no manure in the intervening years.

(*b*) At 6 maunds—494 pounds per acre applied in alternate years and no manure in the intervening years.

(*c*) At 3 maunds—247 pounds per acre applied yearly.

The first crop of 1915 and the second crop of 1916 were injured by floods and no results were available. The yields, as far as they have been obtained for three years, are shown in tabular form :—

	Yield per acre, in pounds.				
	1915 2nd crop.	1916 1st crop.	1917 Two crops.	1918 Two crops.	Average Annual crop.
1	2	3	4	5	6
Bonemeal 247 pounds per acre in alternate years.	3,336	1,537	4,434	2,612	2,992
No manure	2,788	1,435	4,164	2,300	2,672
Bonemeal 494 pounds per acre in alternate years.	2,962	1,570	4,277	2,142	2,738
No manure	3,013	1,536	4,066	2,250	2,716
Bonemeal 247 pounds per acre yearly.	2,902	1,605	3,812	2,250	2,642
No manure	3,065	1,475	3,353	2,451	2,586

The disturbing effect of the floods in the first two years and again in the present year, makes this experiment of little value. The average yields however indicate that the light application in alternate years will be more satisfactory than the others.

The question as to whether or not any application of bonemeal is likely to yield a profit on soil, such as that of Karimganj Farm, can only be decided by a continuation of the experiment and accordingly similar work is again being carried out.

(2) *Green manuring for rice crop* versus *no manure*.—This experiment, started in 1915 with cowpea and *Dhaincha*, was continued since with slight modifications. Duplicate plots were treated with ground limestone at 823 pounds per acre in 1916. The same series of plots was again green cropped in 1917 and 1918, and the average yields for the four years were as follows :—

	Pounds per acre.
No manure	1,635
Dhaincha alone	1,994
Cowpea alone	1,669
No manure	1,756
Dhaincha and 823 pounds ground limestone in 1916 ...	2,129
Cowpea and 823 pounds ground limestone in 1916 ...	1,960

Double cropping with jute and paddy.—(2) It is occasionally objected that the spread of jute growing is objectionable from the point of view that it reduces the area available for food crops. A small area was set aside in order to test how far it might be possible to produce, on the same land, a profitable crop of jute, and follow it by a profitable crop of paddy. The jute was manured with 10 maunds=823 pounds ground limestone, 3 maunds=247 pounds bonemeal, 5 maunds=421 pounds Hyacinth ash and 150 maunds=5·5 tons of cattle manure per acre. The seeds of the Habiganj variety of jute Dhaleswari and of the variety Kakaya Bombai were sown on 14th March 1918 and the crop was harvested on 17th August 1918. The Dhaleswari variety was then quite ready but the Kakaya Bombai variety would have required 3 weeks more. Immediately afterwards the land was prepared and *sail* seedlings were transplanted on 27th August 1918. This crop was harvested on 22nd December 1918, Dhaleswari jute gave at the rate of 701 pounds of fibre per acre, Kakaya Bambai at the rate of 1,274 pounds, that is an average of 987 pounds or 12 maunds of fibre per acre. The price realized was Rs. 7-7-0 per maund equal to Rs. 89-4-0 per acre.

The paddy crop averaged 1,774 pounds or 21½ maunds which at Rs. 3 per maund, the price at which the crop was sold, is equal to Rs. 64-8 per acre.

Cowpea does not grow well on the farm, and even on the limestone area the crops are poor. *Dhaincha* has always grown successfully, and is specially good on the plots manured with ground limestone.

The *sail* paddy crop was slightly damaged in parts by the floods of 1916 and 1918, and therefore the above figures are not absolutely comparative. There would, however, seem to be no doubt of the benefit to the succeeding rice crop of a well-grown leguminus crop, as shown by the crop produced on the *Dhaincha* plots. A somewhat similar increase has been obtained from those plots which received ground limestone as an additional dressing in 1916. It would, however, be difficult to estimate how much of the increased yield was due to the green crop, and how much to the limestone. It is only right to say that the cowpea crop has always been a very small one, even on the limestone plots.

(3) *Dacca selected rices against country rices.*—As in previous years Mr. Hector's selected rices, *Indra sail*, *Lambachikan* and *Kandulia*, were tested against a few of the most productive local rices, and in the present year a variety named Nagra obtained from Chinsura was included.

The experiment was carried out in two separate series. In the first series 9 varieties were grown in plots of ·17 acre each, and the same number of seedlings was transplanted in each plot. In the second series it was arranged that 8 varieties should be tested in duplicate plots of $\frac{1}{10}$th acre. The seedlings of some of the plots of the second series were slightly injured by floods which may somewhat disturb the comparison.

The following table shows the average results of these tests in pounds per acre :—

	First series, 1917.	Second series, 1917.	First series, 1918.	Second series, 1918.	Average.
1	2	3	4	5	6
Kandulia	2,970	2,440	2,129	1,814	2,338
Lambachikan	3,630	2,640	1,964	1,719	2,496
Lati Sail	2,530	2,200	2,869	2,095	2,423
Terabali	3,080	2,636	2,243	2,510	2,618
George Sail	4,042	2,640	2,580	2,138	2,850
Indra Sail	2,832	3,180	3,107	2,357	2,869
Balam	3,794	...	2,691	2,293	...
Hati Sail	3,300	...	2,862	1,973	...
Nagra	...	...	3,135	...	...

In order to make as complete a test as possible of the relative merits of the two varieties *George sail* and *Indra sail*, two further sets of trial were laid down. The first test was carried out on a large scale on the previous year's jute area and here the plots were duplicated eight times. The average yield per acre for *George sail* was 2,491 pounds while for *Indra sail* the average yield was 3,354 pounds. In the second test, which was laid down on slightly lower land, standard test plots each containing 196 plants were arranged under similar condition of cultivation, spacing, etc., and each of the two varieties was planted in ten similar plots. If the average yield of *Indra sail* on these plots be represented by 100 then the average for *George sail* is 116. A similar test was carried out with a promising selection from the local variety Dholmeg, but in the latter case each variety was planted in five standard plots. Again representing the

yield of *Indra sail* by 100, the yield of the Dholmeg selection was 117. There seems no doubt that *George sail* requires deeper water than *Indra sail*, and that given favourable conditions this variety would be hard to beat. Unfortunately the variety as now grown on the farm does not seem to be quite pure ; however selections which were made in the past year should ensure a pure supply of seed for the future.

(4) *Specific gravity selection of paddy seed.*—An experiment to test the method of selecting rice seed by specific gravity was carried out in 1917. The paddy seeds were immersed in saturated brine and only those grains which were found to sink were used for seed.

Selected and ordinary unselected seeds were then grown under similar condition in seed bed, and the seedlings transplanted into similar duplicate plots. The seedlings were transplanted singly at a distance of 9" apart.

The average yields obtained were 1,962 pounds per acre from selected seed, and 1,784 pounds from the unselected seed in 1917, and 1,468 from selected and 1,347 from unselected seed in 1918.

(5) *Ground limestone as manure for paddy land.*—This experiment was started in 1917. Ground limestone was applied at 10 maunds—823 pounds per acre immediately before transplanting the *sail* crop of 1917, and in the year 1918 both a transplanted *aus* and a *sail* crop were grown on this area.

In 1917 the average yield from the lime plots was 2,161 pounds per acre, against 1,906 pounds from the unmanured plot, while in the present year the situation has been reversed, as the unmanured plots have given the heavier yields, the average of the two years crops showing almost identical yields of 1,916 and 1,905 pounds per acre from the unmanured and manured plots respectively. It seems clear from the results that such small applications of limestone have no permanent beneficial effect. This rate was arranged so as to be approximately equal to the cost of the standard application of three maunds of bonemeal.

(6) *A combined variety and manurial experiment on jute.*—Two varieties were tested against one another, *viz.*, Kakaya Bombai which is a pure line selected by the Fibre Expert, Bengal, and a variety obtained from the Habiganj district where is known as Dhaleswari.

The average outturn of fibre in pounds per acre for the four past years was as follows:—

	Kakaya Bombai.	Local variety.
1	2	3
Yield per acre in 1915	2,036	1,224
Ditto in 1916	1,731	1,115
Ditto in 1917	1,441	1,801
Ditto in 1918	1,625	1,193
Average for four years	1,709	1,208

It is only fair to note that in the past season two of the country plots had for some reason rather poor germination, but even after due allowance is made, the yields obtained from the Bengal variety leave no doubt of the great superiority of this selection over any of the ordinary varieties.

In the manurial experiment on this crop the plots were arranged in duplicate, the manures used and yields obtained being shown in the accompanying table. Cattle manure was used at 5·5 ton per acre, ground limestone at 823 pounds, bonemeal at 247 pounds and Water Hyacinth ash at 411 pounds.

Series.	Manures used.	Average yield in pounds per acre.
1	2	3
A	Cattle manure, limestone	1,234
B	Cattle manure, limestone, bonemeal	1,836
C	Cattle manure, bonemeal	1,152
D	Cattle manure, bonemeal, Hyacinth ash	1,683
E	Cattle manure, bonemeal, limestone	1,666
F	Cattle manure, Hyacinth ash, limestone	1,818
G	Cattle manure, Hyacinth ash	1,001
H	Cattle manure	707

One of the duplicate plots in each of C and E had thin germination and only for this, the series would have been an excellent one, as the addition of each individual manure shows an increase except in E where the falling off is no doubt due to this accidental cause.

Bonemeal costs Rs. 3-8 per maund, Hyacinth ash Rs. 2-2 per maund, crushed limestone Re. 1-1-0 per maund, that is Rs. 10-8 each per acre.

The results from a single trial cannot be taken as conclusive but in the above tests each manure has produced a very profitable increase in the crop.

The price realized this year was Rs. 7-7 per maund.

A small area of both varieties of jute was kept for seed, the yield being 946 pounds per acre from the Habiganj variety, as compared with slightly over 300 pounds from the Kakaya Bombai variety.

(7) *Jowar as fodder in the rains.*—Jowar was again tried as a fodder crop for the rains but, owing to the late arrival of the seed and early arrival of the rains, the crop was a total failure.

(8) *Improved varieties of sugarcane from the Jorhat Farm.*—The three varieties B 147, B 376 and striped Mauritius were grown on a small scale.

The farm lands are situated at too low a level for the successful growth of sugarcane on a large scale, but a small area is grown with the object of giving the farm apprentices a knowledge of the cultivation of sugarcane, and of the making of *gur*. In the past season, ·15 acre was under this crop, the yield of *gur* was 7½ maunds and the total price realized Rs. 58.

(9) *Trial of late transplanted rices.*—Owing to the risk of flood damage occurring at any time of the paddy growing season, it is advisable to have a few varieties with as great a range of growing period as possible. With this object *Jhoria* from Sylhet and *Gandhi sail* from Bengal have been grown for the past two years. These paddies bear transplanting later in the season than any other *sail* varieties. Seeds were sown in seed beds on 28th August, transplanted into duplicate plots on 25th September, and harvested on 10th January. The yields obtained were 1,914 pounds and 1,660 pounds per acre from *Jhoria* and *Gandhi sail*, respectively.

Non-experimental crops.

7. A large area of non-experimental rice was grown during the year. Together with the experimental rice, it covered almost the entire area of the cultivated portion of the farm, the balance

being occupied by small areas of sugarcane, and of jute and *dhaincha* which were grown for seed.

The total yield from the rice crop including the experimental *sail* rice was as follows:—

	Approximate area.	Total yield.	Yield per acre.	Average price realized per maund.
1	2	3	4	5
	Acres.	Tons.	Pounds.	Rs. a. p.
Rice (*sail and aspa*)	51·72	46·8	2,028	...
Rice (*aus*)	5·61	3·38	1,352	...
Total in 1918	57·33	50·18	1,978	3 0 0
Total in 1917	53·3	50·93	2,140	1 4 0
Total in 1916	53·90	25·26	1,051	2 8 0
Total in 1915	52·64	47·98	1,991	2 7 0

Dhaincha was kept for seed on an area of ·15 acre, and gave an outturn of 175 pounds, or at the rate of 1,166 pounds per acre.

Cultivation of cold-weather crops.

8. A variety of cold-weather crops was tried in the past *rabi* season. The land was well prepared in October, but the very long and dry cold weather which supervened gave little chance for satisfactory growth. From the experience of the past few years it seems that there is little prospect for successful cultivation of such crops: it is however advisable to cultivate small areas of the principal crops for the purpose of making the farm apprentices acquainted with them.

Potatoes gave a small crop of 3·4 tons per acre, *cheena* gave about 320 pounds and oats 580 pounds per acre, the yield from the other crops, pulses, oil-seeds and cereals, was negligible.

Insect pests.

9. No very serious damage was caused to the farm crops, although different insect pests made their appearance at various times.

The Farm Manager continues to take timely steps to combat any pests of the kind. Hand-picking, catching by light traps and by bag net, were variously resorted to, and the result was that no damage of any consequence was suffered by the farm crops during the year.

In the early stages of the development of the hairy caterpillar the grubs are found clustered together on the leaves of the affected plants. At this stage much damage can be avoided by picking off all leaves bearing clusters of caterpillars and killing the caterpillars in hot water or a little kerosine oil. This method has been very successfully carried out with the jute crop on the farm during the last few years.

The rice bug (*Leptocorisa varicornis*) is the cause of immense damage to the rice crop each year, and particularly to the early varieties. The most effective method of checking the ravages of this insect is to prepare a light cloth about 15 feet long and 4 feet wide. Two boys use this by standing at opposite ends of the cloth, and with a corner in each hand they allow the middle to fall, and bring up the sides until they are about 18 inches apart. One side of the bag net so formed is allowed to sweep along the top of the affected crop, while the workers run quickly across and across the plot. At each end the bag net is closed and twisted to destroy the many bugs which are captured in this way.

The stem borer moth is attracted by any light during the night time and can be easily destroyed on this account. If an ordinary hurricane lamp is suspended over a barrel or tub of water, which has been covered with light film of kerosine oil, the moths will flutter in large number round the lamp and most of them will ultimately fall into the water and be killed by the kerosine. Where no large vessel is available, a small raised pond could be made with mud banks, filled with water and covered with a spoonful of kerosine, and a torch placed over it would provide sufficient attraction.

Receipts and expenditure.

10. The receipts during the period amounted only to Rs. 564-1-3. Seeds were supplied free for demonstration purposes to the value of Rs. 304-8. The value of paddy and other produce in hands on the 31st March 1919 and since sold was Rs. 3,440-1-0. This gives a total of Rs. 4,308-10-3 from which must be deducted Rs. 168-4-9, the value of paddy, etc., in hand at the beginning of the period. The net result is that produce to the value of Rs. 4,140-5-6 was produced during the season 1918-19.

This very satisfactory result was in large measure due to the higher prices prevailing for paddy but a very considerable share of credit is also due to the Farm Manager for the well-thought out arrangements by which he was able to obviate any very serious flood damage. By growing seedlings of deeper water paddies, by keeping reserve seedlings of several varieties in hand, by promptly replanting some of the damaged areas, and filling in others, almost a 16-anna crop was obtained over the whole cultivated area of the farm. This compares very favourably with the eight-anna crop or less, which was the average on areas outside the farm.

The total expenditure for the nine months was Rs. 7,182-2-7 which compares with Rs. 7,453-8-10 in the previous year. It was distributed as follows :—

	1918-1919. Rs. a. p.
Establishment	2,131 2 2
Petty construction, including fencing, roads, bridges, etc.	1,453 7 6
Purchase of machinery	8 0 0
Purchase of cattle	135 0 0
Feed of cattle	494 9 7
Seeds, plants and manures	27 6 9
Wages of labourers	1,731 2 5
Petty repairs	642 15 1
Purchase and repair of furniture... ...	80 0 0
Books, maps and periodicals	31 1 0
Service postage stamps and telegrams ...	25 0 0
Cost of land	85 9 7
Unspecified charges	336 12 6
Total	7,182 2 7

Owing to various causes the expenditure is proportionately heavier than in the previous year. The expenditure under "Petty construction" has increased owing to costs incurred in burning one lakh of bricks which are to be used in the coming year for new buildings. Four old bullocks were sold and four purchased to replace them, which is responsible for an increase under the head "Purchase of cattle." A breeding bull was maintained at the Farm in addition to the usual number of working stock, and as prices of food stuff have gone up, a

considerably increased expenditure was necessary for "Feed of cattle." A sum of Rs. 85-9-7 was spent in the purchase of a small piece of land to enable improvements to be made in the drainage of the farm. Further sums were spent in raising an earthen bund round the experimental area which should keep the rice selection work safe unless record breaking floods occur. A site has been raised for cattle sheds which has still further increased the expenditure on earthwork. The extra expenditure incurred under these various heads amounts to upwards of Rs. 1,600.

Staff.

11. The sanctioned establishment of the farm consists of :—

	Rs.
1 Farm Manager	100—5—200
1 Assistant Farm Manager ...	25—1-8—40 *Plus* Rs. 10 Local allowance.
1 Farm clerk	25—1-8—40
1 Peon	8 0 0

In addition, arrangements are made for the entertainment of six apprentices to be trained for eventual employment as Agricultural Demonstrators. The period of training extends to 2 years.

The first apprentice trained at the farm was appointed as Demonstrator in August 1915 ; he served in that capacity until 1917 when he was appointed Assistant Farm Manager. During the year 1916-17 three, during 1917-18 two, and during the present period two young men completed their training. With the exception of one young man who suffered from ill-health and was unable to take up work, all these men have been appointed as Demonstrators and most of them are working satisfactorily. Two Demonstrators were required to help in demonstration work, and they were sent out to the districts towards the end of the period. The vacancies have been filled up by the appointment of two Muhammadans, which gives two Hindu and four Muhammadan apprentices. The scheme of giving a preliminary training to young men of the Bhadralog class intended for scholarships at Sabour is to be continued during the coming year if suitable men offer. These young men, who are given an opportunity of qualifying for posts as Agricultural Inspectors, are trained in practical agriculture for one year before proceeding to Sabour.

Babu Surendra Nath Gupta, Farm Manager, Babu Girindra Kumar De, Assistant Farm Manager, and Babu Jatindra Chandra Dutta, Farm Clerk, remained in charge of their respective posts throughout the period.

J. W. McKAY,
Deputy Director of Agriculture,
Surma Valley and Hill Districts.

CAMP KARIMGANJ,
The 3rd May 1919.

REPORT OF THE KAMRUP SUGARCANE EXPERIMENT STATION FOR 9 MONTHS ENDING THE 31ST MARCH 1919.

1. *Introductory.*—The objects and scope of this experiment were described in paragraph 1 of the annual report of the Kamrup experiment station for the year ending 30th June 1914. As explained therein, it was proposed to reclaim an area of about a thousand acres of land for sugarcane cultivation, but up to the present it has been found possible to open out and keep under cultivation only about 800 acres, and without the aid of additional cultivating machinery, such as motor tractors with suitable implements, it is extremely doubtful whether the present area is capable of extension. The steam cultivating tackle is excellent for breaking up new land and preparing it for cane, but for other crops in the rotation some auxiliary implements are required for working up the finer tilth required for small seeds, and also for the ploughing in of green manure crops. Probably the addition of a disc plough and disc harrow to the steam tackle would go a long way to supply the deficiency, but owing to the fact that the work of planting cane and also the cultivation of land coming out of cane comes together with a rush in the spring, extra power in the form of motor tractors is required in order to get the spring cultivation done in due season, and also to enable us to get the full value of the existing steam tackle in extending the area under cultivation. This was recognised some time ago, and enquiries have been made with regard to motor tractors and also extra implements, but, owing to the war, financial considerations have hitherto prevented any action being taken. It is hoped that now the war is over and the conditions with regard to the import of machinery are improving, these deficiencies will be made good.

No new land was opened up during the year under report, so the total area under cultivation remains the same as stated in last year's report, *viz.*, 817 acres. Of this, 493 acres were under sugarcane—plant cane 230 acres and ratoon cane 263 acres, and the remainder under other crops.

Last year's report dealt with the crop harvested in the spring of 1918, and also up to June 30th, 1918 with the progress of the young crop planted in 1918. The present report carries on

up to 31st March 1919 only, the date for the submission of the annual reports of the Agricultural Department having been changed recently by Government, and deals with the subsequent development of the crop harvested in the spring of 1919, and the preparation of the land for and the planting of the new crop now on the ground.

2. *Land and communications.*—The site of the experiment is situated in North Kamrup under the Bhutan Hills about 17 miles by road north of Nalbari station, Eastern Bengal Railway, and lies between the new and old Pagladiya rivers and near the village of Topolia. The farm is approached from Nalbari station by a public road northward to Garbhitar village, some 10 miles, where a village track leading to Khagrabarigaon has been widened out and made into a cart road and extended to the present farm site which is 7 miles from Garbhitar. The greater portion of this tract consists of high land carrying tall grass jungle, with occasional swamps which are, however, capable of drainage, the fall from the hills to the south being from 15 to 20 feet per mile.

3. *Rainfall.*—Farm records have been kept since January 1915. The following table shows the figures for the year under report with monthly averages to date :—

Month.	Inches.	Average inches to date since January 1915.
1	2	3
April 1918	4·80	5·89 (average of 4 years).
May „	9·25	15·58 „
June „	25·23	18·97 „
July „	31·65	24·78 „
August „	19·38	17·44 „
September „	10·04	8·79 „
October „	0·30	5·57 „
November „	0·93	0·28 „
December „	Nil	0·06 „
January 1919	Nil	0·15 (average of 5 years).
February „	0·26	1·58 „
March „	Nil	2·85 „
Total ...	101·84	111·44

The main feature of the season was the extraordinary dryness of the weather in October, and the long drought which commenced early in November and lasted until the end of the year under report. October had only one shower giving less than $\frac{1}{3}$ inch of rain against an average of $5\frac{1}{2}$ inches, while, with the exception of one slight shower in the middle of February, the usual spring rains failed us entirely. This drought, while facilitating the preparation of the land for the crop to be planted in the spring, was detrimental to the standing cane crop, which apparently ceased to grow early in October and was thus somewhat stunted especially in the latter planted areas. It also retarded the germination of the new crop of cane in the spring, but its full effect in this respect cannot be determined until later.

Seventy-six inches, *i.e.*, about 75 per cent. of the total rainfall, fell during the months June to August inclusive, and this long period of wet weather put a complete stop to cultural operations with the steam tackle, with the result that only on a small portion of the area sown with green manure crops could the crops be ploughed in.

4. *Soil.*—The following report on some samples of soils examined has been received from Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

KAMRUP FARM SOILS.

	Lab. No. 22.	Lab. No. 23.	Lab. No. 24.	Lab. No. 26.
	Block I. 0-9″.	Block I. 9-15″.	Block II. 0-9″.	Block IV. 0-9″.
1	2	3	4	5
A. Soluble in 26 per cent. Hydrochloric Acid with 48 hours' digestion at 100° C.	Per cent.	Per cent.	Per cent.	Per cent.
Phosphoric Acid (P_2O_5) ...	0·079	0·065	0·074	0·064
Potash (K_2O) ...	0·817	0·938	0·873	0·632
Lime (Ca O) ...	0·273	0·210	0·168	0·196
Magnesia (Mg O) ...	0·864	0·955	0·869	0·739

KAMRUP FARM SOILS—*concld.*

	Lab. No. 22.	Lab. No. 23.	Lab. No. 24.	Lab. No. 26.
	Block I. 0-9".	Block I. 9-15".	Block II. 0-9".	Block IV. 0-9".
1	2	3	4	5
B. Available, *i. e.*, soluble in 1 per cent. Citric Acid with 7 days' digestion, Dyer's method.	Per cent.	Per cent.	Per cent.	Per cent.
Phosphoric Acid	0·022	0·019	0·030	0·023
Potash	0·009	0·006	0·013	0·009
C. Moisture in air-dry soil	1·41	1·34	1·41	1·00
Loss on ignition (Organic matter and combined water).	4·62	3·08	4·79	3·33
Nitrogen	0·112	0·077	0 119	0·091
Humus	1·70	1·50	1·90	1 60
Reaction	Acid ...	Very slightly alkaline.	Acid ...	Acid
Lime (CaO) requirement per 19 million of air-dry soil, in lbs., by Veitch's test.	460	nil	460	350
Carbonate of lime	0·017%	0·015%	0 012%	0·015%

"Results are expressed as percentages on air-dry samples.

NOTES.—These soils present a striking similarity. Reserve Phosphoric Acid is on the weak side while the available amounts of that element of plants food are good.

Total Potash is high, more than would be expected in this class of soil at first sight. Available Potash is on the weak side in all except No. 24. Lime will probably bring the reserves into use.

Lime is low and Magnesia high.

Three out of four samples are acid in reaction.

Having regard to the low lime and high magnesia content, as also to the small amount of carbonate present; to the existing state of combination of the humus and to the reaction, I am of opinion that the primary requirement of these soils is lime, using preferably ground limestone. I anticipate a 25 per cent. increase in the cane crops as a result as a minimum.

Nitrogenous manuring for a crop like cane will be necessary and phosphatic manuring will have to be resorted to ere long."

5. *Buildings, etc.*—The buildings consist of the Manager's bungalow, staff quarters, office with dispensary, coolie lines, cattle shed, godown, smithy, etc. At present all these are of a temporary type except the Manager's bungalow. It is proposed to erect a more substantial godown with a pucca floor during the coming year.

A temporary laboratory was erected near the factory during the year at a cost of Rs. 633-13, and eight new coolie huts were added to the lines.

No new fencing was purchased, the cultivated area being already enclosed by 4½ miles of wire fencing. This excludes pig and deer but not bears, which have caused a good deal of damage in former years. This year, however, the bears were kept in check by armed choukidars, and in consequence the damage to the cane was much less than usual.

6. *Cattle.*—There are 73 bullocks on the farm at present, of which 23 belong to Government and 50 to the factory. Of the 83 heads mentioned in the last year's report, 6 died during the year (one Government and 5 factory), 10 factory bullocks were taken over by the factory, and Government purchased 3 pairs locally at a cost of Rs. 160 per pair.

7. *Water-supply.*—Norton tube wells are used with great success, and an excellent supply of drinking water is available all the year round. These wells, distributed over the cane area, provide water also for the engines. In addition, a permanent running stream close by the coolie lines supplies water for washing purposes, etc.

8. *Labour.*—As in previous years, labour was recruited from Ranchi personally by the Manager with the sanction of the Government of Bihar and Orissa. For the last two years recruiting has been done on a 12 months' basis instead of 6 months. The system works excellently, and a certain number of coolies have settled down here. As a rule this imported labour force keeps very good health, but in October 1918 the prevailing influenza epidemic swept through this tract of country causing a severe outbreak on the farm which resulted in 45 deaths.

In addition to the imported labour a number of Kacharis from villages near by and a few Nepalis also work on the farm.

At the end of the year the total imported labour force amounted to 103 men, 193 women and 81 children. The local labour is very casual and fluctuates widely, but at the end of the year, which is a very busy season on the farm, the numbers actually employed were 125 men, 109 women and 35 children.

9. *Cultivating tackle.*—This comprises:—

2 steam tractors, Fowler's compound engines;

1 five-furrow double ended plough;

1 harrow;

1 cultivator;

1 roller;

1 ridger;

1 leveller;

1 ditcher;

1 motor plough, Fowler-Wyllie.

The steam tackle has continued to work satisfactorily, and is in good condition considering that it has been worked continuously as far as weather permitted since January 1915.

One steel cable 600 yards long was purchased during the year at a cost of Rs. 1,690. No other spare parts were obtainable in India, and could not be imported owing to war conditions.

The Fowler-Wyllie motor plough has been found unsuitable for our purpose, as, owing to its narrow wheel base, it has a tendency to topple over on any land without an even surface.

In view of what has been written in paragraph 1 of this report the question of the provision of extra power implements and spare parts requires serious consideration at once, otherwise it will be extremely difficult if not impossible to carry out our future programme.

10. *Drainage.*—The system of drainage adopted in 1916 and described in paragraph 11 of the report for that year has worked satisfactorily, and no new main channels had to be cut during

the year under report. The water table has been considerably lowered, and the heaviest falls of rain are rapidly carried away. Evidence of the good effect of the drainage scheme is apparent in the fact that about 10 acres of low land in block No. 2, which until last year was only suitable for wet rice cultivation, has now become too dry for rice and has been planted for the first time with sugarcane this year.

11. *Sugarcane crop of* 1918-19.—This comprised 263 acres of ratoons of the plant cane crop of season 1917-18, the results of which were recorded in last year's report, and 230 acres of plant cane which, as reported last year, was planted in the spring of 1918.

The crop was distributed as follows :—

Ratoon, acres.		Plant cane, acres.	
Block No.	5—20	Block No.	11—48
„	6—50	„	12—16
„	7—30	„	13—60
„	8—60	„	15—25
„	9—55	„	16—15
„	10—48	„	17—54
		„	18—12
Total	... 263	Total	... 230

The ratoon crop again suffered severely from the fact that the previous plant cane crop was taken off very late in the spring of 1918. This was unavoidable owing to the factory not being ready to commence work until the beginning of March, and when it did start it worked only intermittently until April 1st. In the meantime the cane was kept on the ground waiting for the factory to start again, but when it was realised that there was no hope of this the cane was cut and thrown away as rapidly as possible. Harvesting however was not completed until the beginning of May, and actually it was not possible to remove some of the cane from the fields until the end of May. Consequently the bulk of the ratoon crop got a very late start, and in some blocks cultivation was not possible before June. After harvesting the plant cane crop the trash on the fields was burnt

as far as possible. During the growing season the crop was hoed 3 to 4 times and hand-weeded 4 to 5 times. The cane was "stripped" in September-October. No other cultivation was given and no manure was applied.

Harvesting commenced on December 28th when the factory required cane for trial, and more than half of the ratoon crop was harvested in January and supplied to the factory. Of the remainder some had to be thrown away and some was still standing at the end of the year in the hope that the factory would eventually be in a position to deal with it.

The plant cane of 1918-19 is mentioned briefly in paragraph 13 of last year's report, as having been planted from the latter end of January 1918 to April 1918. The whole area was new land planted with cane for the first time, but about 108 acres in blocks No. 11 and 13 had been reclaimed the previous year, while the remainder was reclaimed just previous to planting. It has been found that opening up land a year in advance of planting has a very beneficial effect on the subsequent crop as will be seen from the figures given in paragraph 12 of this report. This crop received the same cultivation as the ratoons, and similarly no manure was applied. Germination was on the whole good, and the young cane got a good start especially on the earlier planted areas. Blocks No. 17 and 18, having been planted late owing to unavoidable circumstances, were consequently much more backward than the remainder of the area. The effect of the season on the subsequent growth of the cane is referred to in paragraph 3. The cane, which in September gave every promise of a bumper crop, was undoubtedly adversely affected by the exceptionally early stoppage of rainfall, with the result that the outturn fell short of what was expected.

Harvesting commenced on 28th January and was completed on April 1st. Owing however to frequent breakdowns in the factory and in view of the fact that even when actually in action it was working up to only about half its estimated capacity and could not possibly deal with the whole of the crop, it was decided to go on harvesting the cane whether the factory could take it or not in order to give the young ratoon crop a chance. Consequently a large proportion of the plant cane crop had to be thrown away.

It is a regretable fact that, owing to the unsatisfactory condition of the factory, we have again to record the loss of the

greater part of our crop. The actual amount of cane taken by the factory up to 31st March was 1,572 tons; since then up to the time of writing (April 27th) an additional 283 tons has been taken, making a total of 1,855 tons, of which 1,075 tons were plant cane and 780 tons ratoon. There is still about 25 acres of ratoon cane left standing in the field, but it is extremely doubtful whether the factory will be able to deal with it, as the fine weather has broken and showery weather has set in.

The total number of days on which cane was supplied to the factory since 28th December up to date is 58, but this does not accurately represent the number of days that the factory was actually working, as on some days that cane was supplied the factory did not work, while on some days when cane was not supplied the factory was working off accumulations.

12. *Outturn of cane.*—Owing to the irregular demand of the factory for cane and the fact that large quantities of cane had to be thrown away, as explained in the last paragraph, accurate weighments of the whole of the crop were impossible. In the case of the ratoon it was possible to weigh the greater part of the crop, but in the case of the plant cane, with one exception, a representative area (usually one acre) only was weighed in each block. The following tables show the results as far as they could be ascertained under the circumstances :—

RATOON CANE.

Block No.	Variety.	Area of Block.	Area weighed.	Weight of cane stripped for milling.	Calculated weight of cane per block.	Weight of cane per acre.	Remarks.
1	2	3	4	5	6	7	8
		Acres.	Acres	Tons.	Tons.	Tons.	
5	B. 147 ...	20	20	46·5	...	2·3	
6	Mixed ...	50	20	81	200	4	Remaining 30 acres was cut and thrown away.
7	Striped Mauritius.	30	30	73	...	2·4	
8	Striped Mauritius.	60	60	186·5	...	3·1	
9	B. 147 ...	55	30	170	313	5·7	The remainder of this cane is still standing. From the 30 acres weighed top cattle from about 15 acres were taken.
10	B. 376 ...	48	48	231	...	4·8	
	Total ...	263					

PLANT CANE.

Block No.	Variety.	Area of block.	Area weighed.	Calculated weight of cane per block.	Weight of cane per acre.	Remarks.
1	2	3	4	5	6	7
		Acres.	Acres.	Tons.	Tons.	
11	B. 376 ...	48	1	1,176	24·5	Rather more than ½ of this was milled and remainder thrown away.
12	B. 376 ...	16	1	377	23·6	Only 29 tons of this was milled. Remainder thrown away.
13	B. 147 ...	60	3	1,578	26·3	Top setts taken from 15 acres for planting, 155 tons cane milled, remainder thrown away.
15	B. 376 ...	25	nil	222	8·9*	Top halves of canes were used for planting, bottom halves were thrown away, as factory was not working.
16	B. 376 ...	15	15	134 actual.	8·9	This field was accidently burnt before harvesting. The whole of the cane was milled.
17	Striped Mauritius.	54	2	626	11·6	Top setts from 15 acres used for planting. 268 tons cane supplied to factory, remainder thrown away.
18	Striped Mauritius.	12	1	128	10·7	Of this 57 tons supplied to factory. Remainder thrown away after top setts were taken for distribution.
	Total ...	230		4,241		

* The yield has been taken as equal to that of the adjacent Block No. 16 to which it was very similar.

According to the above actual weighments and estimates 263 acres of ratoon cane yielded only 1,050 tons, or at the average rate of almost exactly 4 tons per acre. It is needless to remark that a crop like this is practically useless and would not pay for the cost of cultivation, but it has already been noted in the preceding paragraph that this crop never had a fair chance. It is hopeless to expect to get a good ratoon crop unless the previous plant cane crop is taken off before the end of March. Also there is not the least doubt that ratoons require manuring, coming as they do immediately after a heavy crop of plant cane, which is a heavy tax on the soil.

The plant cane gave a total estimated crop of 4,241 tons on 230 acres, or an average of 18·4 tons per acre. This is disappointing in view of the excellent growth that the cane made during the earlier part of the season. It will be noted that blocks 13 and 11 which were cultivated a year in advance of planting gave 26·3 and 24·5 tons per acre respectively, while block 12 gave a very fair crop also. The remainder of the crop

was poor. Blocks 15 and 16 are low, and the crop undoubtedly suffered from the fact that the soil had not been sufficiently weathered before planting. The comparatively poor crops on blocks 17 and 18 can be explained by the fact that they were planted very late on newly-broken up jungle land.

13. *Quality of cane.*—I am indebted to Mr. A. A. Meggitt, Agricultural Chemist, Assam, for the following report. The analytical work was done by an Assistant under his general supervision.

"No analytical work was possible before the middle of January 1919, as the laboratory was not completed in time. Factory work commenced about mid January and continued intermittently until the end of April.

"The same scheme of analytical control as was adopted last year was again carried out. The scheme is tortuous and in some respects unsatisfactory, but with the existing Factory arrangements no other was possible.

"The average results for the whole season were as follows:—

	Per cent.
Expression : Juice on Cane	61·1
Sucrose in juice	17·09
„ Bagasse	7·66
Purity co-efficient of juice	87·2
Fibre in cane	13·65
Sucrose in cane	13·42

The sucrose in cane thus works out at only 78·5 per cent. of the sucrose content of the juice, a figure which is certainly below the truth.

The other figures given in the following table are averages for each variety abstracted from the factory records. In most cases they represent a very considerable quantity of cane, varying from approximately 60 or 70 tons up to as much as 300 tons. It is not desired to lay too much stress on these figures, as on many occasions the cane lay about the factory yard for some days before being milled, and would not be improved as a consequence."

SEASON 1918-19.

Variety.	Date of milling.	Sucrose in juice, per cent.	Sucrose in bagasse, per cent.	Purity co-efficient of juice, per cent.	Fibre in cane, per cent.	Sucrose in cane, per cent.	Remarks.
1	2	3	4	5	6	7	8
B. 376 Plant Cane ...	Mid.-March ...	18·14	3·72	88·9	14·2	14·48	
B. 376 Ratoons ...	Mid.-January ...	16·99	6·97	87·4	11·9	13·09	
Striped Mauritius plant cane.	End-March ...	19·75	9·38	92·1	14·25	15·71	
Striped Mauritius ratoons	Mid.-January ...	17·40	8·31	85·0	...	13·67	Cane lay at factory 7 days before milling.
B. 147 plant cane ...	Mid.-February ...	16·34	5·62	84·9	15·03	12·17	Cane unripe.
B. 147 ratoons ...	End-April ...	16·83	7·82	87·2	14·51	13·36	

14. *Cane nursery.*—It is recorded in last year's report that 15 new varieties of cane were planted in a nursery in the spring of 1918. These varieties were B. 208, B. 6450, B. 3 12, Barbadoes A and B (number uncertain), Java 33a, W. M. Nos. 1, 2, 3 and 4, Panna, Bombai, Kamrup red sport of Striped Mauritius, Red Java and Green Java. All these made good growth except W. M. No. 1 and Barbadoes B., and, with the exception of these two varieties, all the material from the nursery has been planted out in Block No. 14 this season for a preliminary trial in field.

The following table gives some analyses of these canes :—

NURSERY CANES, 1918-19 PLANT CANE.

Variety.	Date of milling.	Juice expression, per cent.	Sucrose in juice, per cent.	Sucrose in bagasse, per cent.	Purity co-efficient of juice, per cent.	Sucrose in cane, per cent.	Remarks.
1	2	3	4	5	6	7	8
B. 3412	17th January 1919 ...	73·8	12·50	4·68	79·9	10·45	All these varieties were harvested 10 to 11 months after planting and before they were ripe with the object of discovering early ripening varieties. It will be seen that B. 208, Red Java, Red Mauritius, B. 6450 were very good at this time, while White Bombai, J. 33a and White Mauritius No. 3 were all good enough to mill.
White Bombai ...	17th „ „ ...	76·5	14·84	5·81	85·6	12·72	
Red Java	18th „ „ ...	75·6	16·71	7·64	85·4	14·50	
Tana	18th „ „ ...	70·8	12·71	4·35	78·9	10·27	
B. 208	18th „ „ ...	75·1	19·63	8 66	94·2	16·90	
Barbadoes A. ...	20th „ „ ...	73·8	13·18	3·93	80·4	10·80	
White Mauritius No. 2 ...	21st „ „ ...	70·3	12·75	4·47	79·3	10·29	
White Mauritius No. 3 ...	22nd „ „ ...	63·5	16·28	5·91	89·2	12·50	
Red Mauritius ...	23rd „ „ ...	72·4	16·82	7·30	92·7	14·20	
White Mauritius No. 4 ...	24th „ „ ...	73·2	13·56	5·00	83·9	11·20	
B. 6450	25th „ „ ...	74·7	16·33	4·73	88·7	13·40	
J. 33a	27th „ „ ...	68·0	15·42	6·68	86·6	12·60	

15. *Planting of the present crop.*—Planting commenced at the beginning of January when the nursery cane was planted out in Block No. 14, and was finished in the middle of March. The following table shows the areas planted, the varieties and the time of planting, etc :—

Block No.	Area, acres.	Variety of cane.	Date of planting.	Remarks.
1	2	3	4	5
14	30 4	Nursery varieties B. 376.	January 2nd to 20th.	Land broken up in 1917. *Dhaincha* for seed grown in 1916. Planting done on good moisture.
3	60	Striped Mauritius.	21st January to 3rd February.	Land first broken up in autumn, 1915. Plant cane, 1916, Ratoon cane, 1917. *Dhaincha* for green manure, 1918.
5 half-block.	30	B. 147 ...	14th to 18th February.	Land first broken up at end of 1915. Plant cane, 1916. Ratoon, 1917. Fallow during 1918.
2	55	B. 147 ...	4th to 13th February.	First broken up Spring, 1915. Ten acres were under paddy in 1916 to 1918. Ten acres cane, 1915, ratoon, 1916, indigo, 1917, fallow, 1918. Remainder under sundry crops in 1915, plant cane 1916 and ratoon, 1917, Fallow, 1918, except 5 acres which carried *Jowar*.
1	60	B. 376 ...	1st to 15th March.	First broken up January 1915. Plant cane, 1915, Ratoon, 1916, 2nd ratoon 1917. Cowpea rains, mustard *rabi*, 1918.
Total ...	239			

No manure was applied at the time of planting, but it is proposed to give a top dressing of 20 maunds rape cake per acre to Blocks 1, 2 and 5, and 15 maunds per acre to Block 3. This will be hoed into the land during the coming growing season.

With the exception of a portion of Block No. 2, moisture was fairly good in all blocks at the time of planting, but germination has been considerably retarded by the exceptionally dry spring. This year as last year reserve nurseries have been planted along the roadsides for filling vacancies.

The plant cane crop of 1918 is being ratooned this year, thus the total area under cane in 1919 is 469 acres, of which 239 acres is plant cane and 230 acres ratoon.

16. *Other crops.*—*Dhaincha* (*sesbanea aculeata*) for seed was grown on part of Block No. 14, and a yield of 70 maunds of seed was obtained from about 20 acres. *Jowar* (*Sorghun vulgare*) yielded 40 maunds of seed on 5 acres of Block 2.

Green manure crops.—Cowpeas for green manure were sown on Blocks Nos. 1 and 4. The growth was very uneven, but there was a fairly good crop on the whole. Owing to the extremely wet season, however, the crop could not be ploughed in and rotted on the field. Although the full effect of this crop as green manure was not obtained, still the crop was by no means altogether wasted, as the rotting vegetation was ploughed in subsequently.

Dhaincha for green manure was sown on Block No. 3, giving a very luxuriant crop. Unfortunately owing to weather conditions only half could be ploughed in, the rest being burnt off at the end of the rains.

The problem of getting green manure crops ploughed in is extremely difficult at present. This is to a great extent due to the lack of suitable implements. This year we are trying sowing *dhaincha* earlier in the hope that some of it at least will be fit for ploughing in before the break of the monsoon.

Rabi crops.—Mustard was sown on Block No. 1, but, owing to bad tilth and short rainfall, germination was poor and only 77½ maunds of seed was obtained from the 60 acres. On Block No. 2 *matikalai* was sown on 20 acres and cowpea for seed on 10 acres, but germination was so poor that they were ploughed up.

17. *Spring sowings*, 1919.—Land not under sugarcane in 1919 is being cropped during the rains as follows.—Blocks 4, 6, 7, 8, 9 and 10 *dhaincha* for green manure; Block 5 northern half 25 acres *dhaincha* for seed and 5 acres Finlow's selected jute for seed.

Thirty acres of Block 4 have been given a dressing of 32 maunds crushed limestone per acre before sowing the *dhaincha*, in preparation for future manurial experiments.

18. *Expenditure.*—This is shown in the following statement. Expenditure from April 1st to June 30th, 1918, has already been given in last year's report, but, in order to make the statement complete for the financial year 1918-19, it is included again in a separate column.

Heads.	From 1st April 1918 to 30th June 1918.	From 1st July 1918 to 31st March 1919.	Total.
1	2	3	4
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Establishment.			
Manager	3,000 0 0	9,000 0 0	12,000 0 0
Clerks	225 0 0	675 0 0	900 0 0
Compounder	90 0 0	270 0 0	360 0 0
Peons	90 0 0	270 0 0	360 0 0
Tackle Assistants	547 0 0	1,702 3 0	2,249 3 0
Muharrirs	135 0 0	385 0 0	520 0 0
Sugar Analyst	100 0 0	270 15 6	370 15 6
Additional establishment... ...	...	20 0 0	20 0 0
Total ...	4,187 0 0	12,593 2 6	16,780 2 6
Special Contingencies.			
Implements, machinery, etc. ...	51 0 0	3,376 0 0	3,427 0 0
Buildings	...	820 1 0	820 1 0
Fencing	1,555 8 0	...	1,555 8 0
Total ...	1,606 8 0	4,196 1 0	5,802 9 0
Regular Contingencies.			
Wages of labourers	11,732 12 3	37,694 8 3	49,427 4 6
Feed and purchase of cattle ...	...	3,998 7 0	3,998 7 0
Seeds, plants and manure ...	8 7 0	1,640 3 0	1,648 10 0
Petty repairs...	66 0 0	1,178 13 0	1,244 13 0
Unspecified charges	277 8 6	4,788 9 3	5,066 1 9
Fuel	500 14 0	5,898 1 0	6,398 15 0
Stores, oil, etc.	...	997 15 0	997 15 0
Total ...	12,585 9 9	56,196 8 6	68,782 2 3
Grand total ...	18,379 1 9	72,985 12 0	91,364 13 9

Under the head "Unspecified charges" is included a sum of Rs. 4,065-3-9 paid to the Factory owner on account of transport of machinery, etc., and repair of a boiler.

With regard to receipts, it is impossible to give the figures at present, as milling has not yet been finished and accounts have not been settled with the factory. The price we get for the cane supplied depends upon its sugar content and the average price obtained for the sugar, and until the sugar has been sold it is impossible to effect a settlement.

The actual amount credited to the treasury during the year was Rs. 25-10, being the balance of the price of sugarcane

cuttings sold in 1918. This year the farm supplied 255,500 sugarcane setts, some of which were sold at annas 8 per hundred to cultivators, and some were used for demonstration purposes. The value of these setts was Rs. 1,277.

19. *Staff.*—The staff during the year consisted of—

		Rs.	
	Manager on	1,000	per mensem.
	Clerk on	75	„
Engine staff	One mistry on	55	„
	Two Engine drivers on ...	22	„
	Three 2nd Engine drivers on ...	18	„
	Two Engine attendants on ...	15	„
	One godown muharrir on ...	20	„
	One muharrir	25	„
	One compounder on ...	30	„
	Three peons on	10	„

From November 1918 an extra fitter on Rs. 35 per mensem has been employed on the steam tackle.

From April 1st, 1919, Srijut Sarbananda Sarma, who has held the post of clerk for the last four years, was appointed Assistant Manager on Rs. 100 a month, and another clerk was appointed on Rs. 50 a month in his place.

20. *General.*—The Hon'ble the Chief Commissioner, the Chief Secretary and the Deputy Commissioner, Kamrup, visited the farm in December 1918.

The Director of Land Records and Agriculture, the Deputy Director of Agriculture and the Agricultural Chemist inspected the farm frequently throughout the year.

In August 1918 the Assam Administration entered into a new agreement with the Mill owner to grow cane under certain conditions for the factory until 31st March 1924. Since then a Company, Assam Sugar Estates and Factories, Limited, has been formed, with Messrs. Bird and Company of Calcutta as Managing Agents, to take over the concern from Mr. Maxwell, formerly the Mill owner.

Since the close of the year (March 31st), the farm has been visited by a very destructive beetle belonging to the Dynastines family previously unknown as a pest on sugarcane. This beetle was first noticed at the end of the first week of April, and is now found on all parts of the farm. It attacks both plant and ratoon cane working entirely underground, and eats through the young shoots at the base. It is also found boring in the setts of

plant cane and in the stumps of ratoon cane. No remedy has yet been discovered. The damage at present cannot be estimated, as all the cane has not germinated yet, also it is hoped that tillering will take place below the points attacked, and that a new crop of young shoots will come up.

KAMRUP FARM,
The 27th April 1919.

A. G. BIRT,
Deputy Director of Agriculture,
Assam Valley.

REPORT ON AGRICULTURAL DEMONSTRATIONS, IN THE ASSAM VALLEY CIRCLE, INCLUDING THE GARO HILLS AND SADIYA FRONTIER TRACT, FOR NINE MONTHS ENDING THE 31ST MARCH 1919.

In accordance with Government orders changing the termination of the Agricultural year from 30th June to 31st March, this report deals with the period of nine months from 1st July 1918 to 31st March 1919.

2. *Staff.*—During the period under report the demonstration staff in the Assam Valley was reinforced by the appointment of an Agricultural Inspector and two demonstrators to the Lakhimpur and Goalpara districts. With these additions the staff in the Valley now consists of one Superintendent, five Inspectors and twelve demonstrators. Only one district, namely, Darrang, now remains without any Agricultural staff, and, with the posting of an Inspector to this district and possibly the appointment of an extra Inspector as leave reserve, the superior staff for demonstration work in the Valley will be complete. The staff of demonstrators who assist the Inspectors is still very weak, but is being gradually augmented as rapidly as trained men can be turned out from the Jorhat farm.

Maulvi Fazlal Haq Ahmed, Superintendent of Agriculture, was in charge of the work in this circle until September 1918, when he was transferred to the Surma Valley and Srijut L. Barthakur took over charge. At the same time the headquarters of the Superintendent of Agriculture, Assam Valley, was transferred from Jorhat to Gauhati.

Mr. Barthakur was on tour for 103 days, and visited all the districts and subdivisions within his charge. Soon after taking over charge he had to take 19 days' privilege leave owing to an attack of influenza.

Babu Satyendra Chandra Dutt held the post of Agricultural Inspector, Kamrup, throughout the year. He was also in charge of the Seed Depôt, Gauhati, up to November 23rd, 1918, when he was relieved by the Superintendent of Agriculture. He spent 161 days on tour, and for about a month was on special duty in connection with the distribution of sugarcane setts from the Kamrup farm. To assist him in demonstration work he had 3 demonstrators headquartered at Gauhati, Palasbari and Nalbari.

Srijut Golok Chandra Bora was in charge of demonstration work in Nowgong district. He was on tour for 200 days inclusive of journeys within 5 miles radius of headquarters. He was assisted by two demonstrators, one at Nowgong and the other at Kampur. The work in this district is hampered by lack of communications; also it was necessary to change both demonstrators during the year.

Goalpara district was brought into the scheme of demonstration work this year for the first time by the transfer of Srijut Lalit Mohan Das from Karimganj and his appointment as Agricultural Inspector, Goalpara, with headquarters at Dhubri, with effect from 15th January 1919. Since joining his new post he was on tour for 47 days. He has two demonstrators, one posted at Dhubri and the other at Goalpara. Recently he has been placed in charge of the work in the Garo Hills in addition to that of his own district.

Srijut Devi Prasad Gohain continued in the post of Agricultural Inspector, Sibsagar. He was on tour for 172 days, and also spent 20 days in charge of the distribution of sugarcane setts from the Jorhat farm. He was assisted by 3 demonstrators posted at Jorhat, Sibsagar and Golaghat.

Srijut Mohi Chandra Gogoi was appointed Agricultural Inspector on probation with effect from 8th July 1918. He was under training with the Agricultural Inspector, Kamrup, for about 4 months, and with the Agricultural Inspector, Sibsagar, for about a month. Subsequently he was appointed Agricultural Inspector, Lakhimpur, and joined his new post at Dibrugarh on January 13th, 1919. Including his period of training he was on tour for 147 days. Two demonstrators were sanctioned for the district, but up to the end of the year only one post had been filled.

The post of Agricultural Inspector, Sadiya Frontier, was held by Mr. M. Smith, who continued to work under the orders of the Political Officer at Sadiya. The work is supervised as far as possible by the Deputy Director of Agriculture.

A certain amount of work is being done in the Garo Hills by a Garo demonstrator, who until recently was under the control of the Agricultural Inspector, Khasi and Jaintia Hills. Towards the close of the year, the demonstrator was placed under the supervision of the Agricultural Inspector of the adjacent district Goalpara for the sake of convenience, since the main line of communications with the Garo Hills passes through that district.

3. *Demonstration work in the Assam Valley.*—This was continued on similar lines to that of previous years in Kamrup,

Sibsagar and Nowgong districts, and, on the appointment of the additional Inspectors, was extended to Goalpara and Lakhimpur districts.

The work was distributed under the following heads :—

(1) *Rice.*—Manuring and variety demonstrations.

(2) *Sugarcane.*—Demonstration with superior varieties green manuring for cane, and the use of the three-roller iron crushing mill.

(3) *Potatoes.*—Demonstrations with superior varieties from Shillong, and large *versus* small tubers for planting.

(4) *Jute.*—Finlow's "Kakiya Bombai" *versus* local varieties.

(5) *Fodder crops and miscellaneous crops.*

(6) *Meston ploughs.*

(7) *Conservation of cattle manure.*—In covered pits.

4. *Rice—Residual effect of manures in the third year.*—Bonemeal and Flour phosphate were applied in 1916 at the rate of 3 maunds per acre costing Rs. 9 and Rs. 10-8 per acre, respectively. The cost of green manuring with *dhaincha* was not more than Rs 2 per acre. The residual effect of this treatment in the third year is shown in the following table :—

Yield in lb. of grain per acre.

District and centre.	Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	*Dhaincha* plot.	*Dhaincha* and Bonemeal plot.
1	2	3	4	5	6
SIBSAGAR.					
Bhojo	1,276	1,969	...	...	...
Langkak	1,138	1,320	...	...	...
Betbari	1,393	2,281	...	...	...
Rahdhola	1,006	933	...	...	...
Meleng	1,110	...	1,251	...	...
Patiagaon	1,546	...	1,348	...	...
Morabazar	1,104	...	1,358	...	...
Parbatia	1,030	...	1,443	...	...

Yield in lb. of grain per acre—concld.

District and centre.	Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	*Dhaincha* plot.	*Dhaincha* and Bonemeal plot.
1	2	3	4	5	6
SIBSAGAR—*concld.*					
Average increase in the third year.	...	423	137	...	...
Previous increase in the second year.	...	102	150	...	...
Previous increase in the first year.	...	184	255	...	...
Total increase ...	...	709	542	...	...
KAMRUP.					
Tongra	854	...	...	854	1,477
Kuara	1,114	...	...	1,401	1,588
Average increase in the third year.	...	...	...	143	548
Previous increase in the second year.	...	...	...	— 38	204
Previous increase in the first year.	...	...	...	180	592
Total increase ...	...	...	...	285	1,344

Valuing the paddy at Rs. 3 per maund, and taking the total increase for the three years, the profit on the manuring works out as follows :—

—	Cost per acre.	Value of increase per acre.	Profit per acre.
1	2	3	4
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Bonemeal	9 0 0	26 0 0	17 0 0
Flour phosphate	10 8 0	20 0 0	9 8 0
G. M. *dhaincha*	2 0 0	10 0 0	8 0 0
Ditto *plus* Bonemeal...	11 0 0	49 0 0	38 0 0

5. *Rice—Residual effect of manures in the second year.*—These demonstrations were commenced in 1917 in Kamrup and Sibsagar, when Bonemeal, Flour phosphate and Rape-cake were applied at the rate of 3 maunds, 3 maunds and 6 maunds per acre, respectively. The cost per acre of the manures was Rs. 9 for Bonemeal, Rs. 10-8 for Flour phosphate and Rs. 10-8 for Rape cake. The cost of green manuring with *dhaincha* is about Rs. 2 per acre.

In Kamrup at Parakuchi one plot which had been given a dressing of 3 maunds per acre of Bonemeal in 1914 was given a similar dressing in 1917 with the result that it yielded an increase of 619 lbs. paddy per acre in 1917, and 563 lbs. in 1918 over the unmanured check plot.

The manurial demonstrations commenced in Nowgong in 1917 having proved unreliable no results are given. The results of the demonstrations in Kamrup and Sibsagar are shown in the following table :—

SECOND YEAR'S RESULTS.

Yield of grain per acre in pounds.

	District and centre.	Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	Flour phosphate and *dhaincha* green manure plot.	Bonemeal and *dhaincha* green manure plot.	*Dhaincha* green manure plot.	Oilcake plot.	Remarks.
	1	2	3	4	5.	6	7	8	9
1st series.	SIBSAGAR.								
	Kakojan	2,020	2,317	1,785	2,114	2,237	1,923	...	
	Koarpur	2,169	2,089	2,204	1,956	1,954	1,554	...	
	Sukanpukhuri	1,088	1,636	1,461	1,480	1,478	1,274	...	
	Betiani	1,335	2,044	2,209	2,305	2,305	1,697	...	
	Average increase in the second year	...	343	261	311	340	— 41	...	
	Previous increase in the first year ...	...	852	1,002	722	870	316	...	
	Total increase in two years ...	...	1,195	1,263	1,033	1,210	275	...	

SECOND YEAR'S RESULTS—*concld.*

Yield of grain per acre in pounds—concld.

	District and centre.	Check or no manure plot.	Bonemeal plot.	Flour phosphate plot.	Flour phosphate and *dhaincha* green manure plot.	Bonemeal and *dhaincha* green manure plot.	*Dhaincha* green manure plot.	Oilcake plot.	Remarks.
	1	2	3	4	5	6	7	8	9
2nd series.	SIBSAGAR.								
	Jaluksin	1,660	2,328	...	...	...	...	...	
	Halikihat	1,106	1,367	...	...	...	...	...	
	Bailungaon	1,942	1,877	...	...	...	...	...	
	Napamua	1,452	...	1,822	...	...	...	...	
	Amalapati	1,413	...	1,568	...	...	...	...	
	Average increase in the second year	...	289	262	...	...	...	...	
	Previous increase in the first year ...	...	242	220	...	...	...	...	
	Total increase in two years ...	...	531	482	...	...	...	...	
3rd series.	KAMRUP.								
	Sandheli	1,407	...	...	...	1,536	1,410	...	*Aus.*
	Dheramtola	2,246	...	...	...	2,120	3,009	...	Two crops *sali* and *aus.*
	Nayagaon	1,245	...	...	...	1,334	1,119	...	*Sus.*
	Rangamati	1,683	...	...	...	2,065	2,109	...	*Sali.*
	Sarpara	803	...	...	...	2,349	968	...	*Sali.*
	Sandheli	1,353	...	...	...	...	...	1,720	*Aus.*
	Dohali	1,495	...	...	...	...	...	1,740	*Aus* and *sali.*
	Sadilapur	1,327	...	...	...	...	...	1,617	Ditto.
	Average increase in the second year	...	...	...	...	404	246	300	
	Previous increase in the first year ...	...	...	...	...	414	183	462	
	Total increase in two years ...	...	...	...	...	818	429	762	

In the first series carried out in Sibsagar district the value of Bonemeal, Flour phosphate and green manuring with *dhaincha* was compared, and also green manuring in conjunction with the phosphatic manures. The results obtained in the two years are difficult to explain. While Bonemeal and Flour phosphate used alone show a profit of Rs. 35 and Rs. 36-12-0 per acre, respectively, and green manure a profit of Rs 8-8-0 per acre, yet when green manure is given in addition to the phosphatic manures the result has been a reduction of profit to Rs. 34-6-0 in the case of Bonemeal, and to Rs. 26-4-0 in the case of the Flour phosphate, although Bonemeal *plus* green manure gave a slightly higher than Bonemeal used alone.

In the second series, also carried out in Sibsagar district, Bonemeal applied in three centres gave an average profit of Rs. 11 per acre over the two years, as against an average profit of Rs. 7-8-0 from Flour phosphate in two centres.

In the third series laid down in Kamrup district *dhaincha* for green manure was tried with and without Bonemeal in five centres. In three cases the addition of Bonemeal resulted in increased outturn, but in the two remaining centres green manure alone gave the better results. Taking the average increases for the two years together, however, the green manure, *plus* Bonemeal shows a profit of Rs. 18-12-0 per acre against Rs. 14 for the green manure alone.

At three centres in Kamrup plots manured with rape cake were compared with no manure plots. The results were very even, and show an average increase per acre over the no manure plots of 762 lb. paddy for the two years or a nett profit of Rs. 18 per acre.

All the above demonstrations are being kept under observation with the object of recording results for the third year.

6. *New manurial demonstrations on rice.*—In 1918 demonstrations with Bonemeal and Flour phosphate were commenced in three new centres in Sibsagar, and with green manure, bonemeal and oilcake in seven centres in Kamrup district. The first year's results are shown in the following table. Except in the case of oilcake the increases in the first year due to manuring are nothing like sufficient to pay for the manures. The effect of the phosphatic manures however should be apparent for at least three years, and the plots will be kept under observation and the results recorded for this period.

NEW RICE MANURIAL DEMONSTRATIONS.

Grain in pound per acre.

District and centre.	Check or no manure plot.	Flour phosphate plot.	Bonemeal plot.	*Dhaincha* plot.	*Dhaincha* and Bone meal plot.	Oilcake plot.	Remarks.
1	2	3	4	5	6	7	8
SIBSAGAR.							
Bachapathar	986	...	842	...	...	...	...
Jogiagaon	292	...	568	...	...	...	...
Rupkalia	1,034	1,177	...	...	...	...	...
Average increase ...	...	143	69	...	...	...	...
KAMRUP.							
Nalbari	1,517	...	....	1,825	1,766	...	*Sali.*
Agdala	1,240	...	...	1,300	1,270	...	,,
Dumnichaki	1,251	...	...	1,575	1612	...	,,
Dokhola	1,225	...	...	1,122	1,579	...	,,
Uparhali	1,708	...	...	...	...	2,346	*Aus & Sali.*
Suradih	2,157	...	...	...	...	2,572	*Aus.*
Satpar	928	...	...	...	...	1,034	*Sali.*
Average increase ...	...	...	...	147	248	386	...

7. *Remarks on paddy manurial demonstrations generally.*—These demonstrations have been continued in the Assam Valley for the last six years on a gradually increasing scale as the demonstration staff has been increased, but in spite of the fact that

in the majority of cases it has been proved beyond doubt that manuring, and especially phosphatic manuring, pays handsomely in the long run, yet it is a melancholy fact that up to the present time practically no impression has been made on the ordinary cultivator, as witnessed by the demand for these manures which is practically *nil*. The reason for this is partly want of enterprise and partly lack of capital amongst the cultivators, and until pressure of population compels them to adopt a more intensive system of cultivation I doubt whether it will be possible to make much progress.

However the demonstrations have not been entirely wasted since they have shown that, on certain classes of land in the Assam Valley, phosphate is one of the main factors in increasing the yield of rice, but in future more care will have to be taken in the selection of sites, and the demonstrations should be strictly confined to old land which has been cultivated more or less continuously for generations, and on which the crops have fallen considerably below the average.

8. *Demonstrations of superior varieties of rice.*—Indra *sail*, a pure variety selected by Mr. Hector at Dacca, and George *sail* selected by Srijut Narayan Borua of Nakacheri were demonstrated in Sibsagar, Kamrup and Nowgong districts. George *sail* is not quite pure, but is a considerable improvement on the local varieties. The results are given in the following table. It will be seen that both the improved varieties, and especially Indra *sail*, have given promising results. There is much more scope for this kind of work than for the introduction of manuring, as the cultivation of a superior yielding variety means no extra initial outlay for the cultivator once he has obtained the seed. At the same time it must be borne in mind that heavier cropping varieties take more out of the soil, with the result that unless manuring is resorted to eventually the yield will gradually diminish until the old level is reached. Thus improvements in Agriculture to be permanent must proceed on parallel lines of better varieties, better cultivation and suitable manuring.

In order to introduce these varieties more widely to cultivators arrangements have been made this year to distribute 40 maunds of Indra *sail* and a few maunds of George *sail* in 5 seer bags, on the understanding that cultivators to whom the seed is given will return an equal quantity to be distributed amongst their neighbours in the following year.

Yield of grain per acre in pounds.

District.	Local paddy.	Indra *sali.*	George *sali.*	Increase.
1	2	3	4	5
SIBSAGAR.				
Average of 9 demonstrations ...	1,391	1,663	...	272
Ditto 6 demonstrations ...	2,169	...	2,406	237
KAMRUP.				
Average of 7 demonstrations ...	1,535	1,693	...	158
Ditto 8 demonstrations	1,530	...	1,626	96
NOWGONG.				
Average of 6 demonstrations ...	1,637	1,843	...	176

In addition to the demonstration with the Indra *sali* and George *sa'i* the following varieties with special characteristics of their own were distributed in small quantities in Kamrup and Sibsagar districts—*boro* paddy, Gandhi *sali* (a late variety from Eastern Bengal), *parang* paddy (late variety of *aus*), C. P. fine *aus*, *Basanta Bahar* (a fine white variety of *aus*), and *Khorika Motha* (a medium white variety of *aus*).

9. *Sugarcane—variety demonstrations.*—Demonstrations of improved varieties introduced and tested on the Jorhat farm have been carried out for some years, and are gradually being extended to all parts of the Valley where sugarcane is grown.

The introduced varieties, *viz.*, striped Mauritius, B. 376 and B. 147 have proved superior to the local varieties both in outturn and quality of *gur*, and that this is appreciated by the cultivators is evident by the large and increasing demand for setts of the superior varieties. The number of setts distributed this season was over 3½ lakhs, of which about one-third were sold at the rate of annas eight per hundred, and the remainder used for demonstration purposes, and distributed to growers on the

understanding that they will reproduce them for further distribution next year. The following table gives details of the demonstrations carried out during the year :—

Outturn of gur per acre in pound.

Locality	Improved variety.	Local variety.	Remarks.
1	2	3	4
SIBSAGAR.			
Bamungaon	2,051 B.376 ..	2,022 Magh ...	Plant cane.
Amguri	8,228 „ ...	2,609 Kolapura	„
Kourghat	2 568 „ ...	1,432 „ ...	„
Ba pathar	7,834 „ ...	7,653 „ ...	„
Napamua	3,720 „ ...	2,541 Teli ...	„
NOWGONG.			
Nikampur	4,557 Striped Mauritus.	2,630 Magh ...	„
KAMRUP.			
Nanera	3,993 „ ...	2,843 ...	„
Khanapara	2,400 „ ...	1,532 ...	„
SIBSAGAR.			
Arundhora	1,860 Striped Mauritus.	529 Kolapura ...	Ratoon cane.
Kamargaon	7,265 Striped Mauritus and B 376.	4,567 „ ...	„
Charingia	8,77 B.376 ...	605 Teli ...	„
Dirnow	5,078 Striped Mauritius.	3,693 Kolapura	„
KAMRUP.			
Dharmatala	3,344 B.147 ..	1,672 ...	„

The results are, as usual, very satisfactory. In the demonstration with plant cane the average yield of *gur* of the improved varieties is 4,419 lbs. per acre against 3,028 lbs. for the local varieties—an increase of 1,391lbs. per acre or over 45 per cent. The demonstrations with Ratoon cane show an average yield of *gur* of 3,705 lbs. per acre for the improved varieties against 2,213 lbs. for the local varieties an increase of 1,492 lbs. per acre or over 67 per cent.

10. *Sugarcane—green manuring.*—As a preparation for cane, cowpeas were demonstrated in three centres in Sibsagar, and *dhaincha* in two centres in Kamrup. Both these crops have proved successful for green manuring on the Government Experiment Stations for many years.

The results are shown in the following table :—

District and centre.	Kind of green manuring.	Variety of cane.	Green manured plot.	Check plot.	Difference.
1	2	3	4	5	6
SIBSAGAR.					
Nowsalia	Cowpea	Magh	1,875	1,694	181
Borkathani	,,	,,	5,021	3,660	1,361
Sensoa	,,	,,	3,569	2,135	1,434
Average	...	...	...	...	992
KAMRUP.					
Dohali	*Dhaincha*	Striped Mauritius.	3,720	1,104	2,616
Nayagaon	,,	,,	2,510	1,300	1,210
Average	...	...	...	...	1,913

The average increase in yield of *gur* in Sibsagar due to green manuring with cowpea was 992 lbs. per acre, value about Rs. 60, while that in Kamrup due to green manuring with *dhaincha* was 1,913 lbs. per acre, value about Rs. 116. It would appear from these results that green manuring for sugarcane in the Assam Valley is one of the most profitable improvements that can be introduced. Land going under sugarcane is usually left fallow the preceding year and often for several years, so green manuring will not mean the loss of other crops. The cost also is small compared with that of direct manuring; in the case of *dhaincha* only some Rs. 2 per acre for seed and in that of cowpeas about Rs. 4-8, in addition to labour for cultivation. The chief obstacle to the spread of this practice is the unenclosed land system common to this country. The cultivator fences his sugarcane crop, but it takes a good deal of persuasion to get him to fence his field a year ahead for the protection of the green

manure crop. However, unless this done, the benefit derived from the cultivation of green manure crops is largely wasted, since the roving herds of cattle and goats let loose in the vicinity of every village will quickly destroy the crop soon after germination.

The remarks in paragraph 8 with regard to improvement in rice cultivation apply equally in the case of sugarcane. No real and permanent improvement can be expected until the cultivators realise that, alongside the introduction of better varieties, their methods of cultivation must be improved, and systematic manuring of the crops must be taken in hand.

11. *Sugarcane mills.*—Demonstrations with three-roller iron sugarcane mills and shallow iron boiling pans were continued as in previous years. As a result of these demonstrations the old wooden mills at one time in common use in the Valley are gradually being replaced by iron mills. The chief obstacle to a more rapid advance is the price of the iron mills which has now increased to Rs. 80 as compared with Rs. 65 the pre-war price. Nevertheless 38 mills were sold during the year, 22 in Kamrup, 12 in Nowgong, 3 in Sibsagar and 1 in Golapara. A few boiling pans also were sold, and some spare parts for mills. Since the introduction of the iron mills was taken up the Department has sold over a hundred mills in the Assam Valley. With their increasing distribution the question of repairs to the mills is becoming difficult, and the need for some agency other than the Agricultural Department to take up the sale of, and to arrange for repairs to the mills, is urgent. It was hoped that, with the increasing demand created by the Department, private enterprise would step in and relieve us of the commercial side of the work, but up to the present there are no signs of this happening. We have now got to the stage when, in the absence of private enterprise, it should be considered whether the Department would be justified in extending the work by employing a staff of mistris to keep the mills in repair.

12. *Potatoes—demonstrations with superior varieties from Shillong.*—A number of demonstrations of the superior varieties Magnum Bonum and King of Potatoes from Shillong were carried out in Sibsagar, Kamrup and Nowgong districts. In each case the Shillong "seed" was planted alongside "deshi seed" ordinarily used by the cultivator and procured from the local bazar. The results given in the following table prove the superiority of the Shillong varieties in every case. The demand for Shillong seed potatoes in the Valley is increasing as a result of theseand of previous demonstrations, and over 600 maunds were sold in 1918 against 213 maunds in 1917.

DEMONSTRATIONS WITH SUPERIOR VARIETIES OF POTATOES.

Yield per acre in pounds.

Locality.	Shillong variety.	Deshi variety—bazar seed.	Remarks.
1	2	3	4
SIBSAGAR.			
Alimur (Majuli)	11,787	8,064	
Mirigaon (Majuli)	9,135	6,261	
Bethari	3,515	1,251	
Sokolaghat	2,700	2,400	
Kaliani	8,140	2,851	
Average ...	5,880	3,454	Average increase 2,426.
KAMRUP.			
Solmari	9,755	5,521	
Majirgaon	4,806	3,454	
Lakhitari	4,492	3,856	
Agdalu	8,061	4,401	
Dowlu	4,961	3,720	
Average ...	6,415	4,190	Average increase 2,225.
NOWGONG.			
Telahi	6,307	1,724	
Gomothagaon	2,953	2,489	
Rangagora	5,746	4,790	
Dhing	7,648	3,805	
Average ...	5,643	3,269	Average increase 2,394.

13. *Potatoes—demonstrations with larger seed.*—The usual practice of cultivators in the plains is to plant very small tubers for the sake of economy in " seed ". In order to prove to them the advantage of planting larger tubers, demonstrations with medium sized *versus* small setts were carried out in Sibsagar, Kamrup and Nowgong districts. The small setts weighed about 70 to 80 to the seer and the medium setts about 30 to 40 to the seer. Thus planting the same number of each size per unit area, the weight of medium sized tubers required was just about twice that of the small tubers.

The results were greatly in favour of the larger seed which gave an average increase outturn of 4,333 lbs. per acre in Kamrup, 2,346 lbs. per acre in Sibsagar and 2,032 lbs. in Nowgong.

The extra cost of the larger setts at Rs. 5 per maund would probably amount to about Rs. 25 per acre, while taking the sale price of the crop at the low rate of Rs. 2 per maund, the average increase due to planting the larger setts amounts to about Rs. 70 per acre in value.

14. *Jute—demonstrations of Mr. Finlow's selected variety " Kakiya Bombai. "*—These were carried out in several centres in Kamrup, Nowgong and Sibsagar districts. The results of the Sibsagar demonstrations are not considered reliable and have been omitted. The results of the demonstrations in the other two districts are given below.

The demand for " Kakiya, Bombai " is increasing rapidly especially in the lower districts of the Valley. This year we purchased 10 maunds seed of this variety from Messrs. Birkmyre Bros., Kamrup, 8 maunds from Maulvi Taiyab Ali, Honorary Correspondent of the Department, and a small quantity from Babu Jyotish Chandra Chakravarty. The bulk of this has been distributed in half pound packets to cultivators.

In order to provide a supply of seed for next year, five acres has been sown on the Kamrup Surgarcane firm and arrangements have been made with Maulvi Taiyab Ali to grow more seed for us. In addition to this three bighas have been sown for seed in Nowgong district.

Outturn of fibre per acre in pounds.

District and centre.	Kakiya Bombai jute.	Local jute.	Remarks.
1	2	3	4
NOWGONG.			
Sonaibali	1,240	1,059	
Rupahi	1,252	1,002	
Jamunamukh	1,176	849	Average increase 252 lbs. per acre.
KAMRUP.			
Amingaon	1,391	1,240	
Sadilapur	707	647	Average increase 105 lbs. per acre.

15. *Fodder and miscellaneous crops.*—Cowpeas alone and cowpeas and maize mixed were grown successfully for fodder at three centres in Kamrup district, but it is reported that cultivators generally take no interest whatever in our attempts to introduce fodder crops. This is not surprising in localities where grazing land is still abundant, but in view of the fact that lack of sufficient grazing grounds is put forward from time to time by various people as an explanation for the existence of an inferior breed of cattle, it is curious that fodder crops are so universally unpopular with the cultivators. The fact is that the extensive communal grazing practised in Assam is itself largely responsible for the condition of the local cattle as, so long as this is continued, breeding will go on in the present haphazard fashion, and feeding will continue to consist of what the cattle can pick up for themeselves.

Miscellaneous cold weather crops were introduced at a few centres in Kamrup, Sibsagar and Nowgong. The exceptionally dry season was unfavourable, and consequently the results were not very promising. Wheat was grown in 3 centres in Sibsagar district, the average outturn being 907 lbs. of grain per acre. In Nowgong the average yield of this crop at two centres was only 433lbs. per acre. Other crops tried included *Masur, Khesari,* barley, gram, Raipur mustard, etc., but owing to the indifference of the cultivators with regard to cold weather crops generally the demonstrations on the whole were not a success.

Garo, Buri and Jati cotton seed was distributed in small quantities to a few cultivators in Kamrup district. In one case Jati cotton is reported to have given an outturn of 14 seers kapas on about 1,000 square feet of land. This is about 15 maunds per acre.

16. *Meston ploughs.*—Demonstrations with these implements were continued during the year and 7 ploughs were sold to cultivators in Kamrup. Although the utility of these ploughs is beginning to be appreciated by the cultivators, the present high price prevents them from becoming popular.

17. *Conservation of cattle manure.*—Demonstrations of the method of conserving cattle manure in covered pits, and in sheds above ground where the water level in the rains is too high for pits, were continued throughout the Valley. During the year 115 of these demonstrations were carried out in Sibsagar district, 21 in Kamrup, 4 in Nowgong and 3 in Lakhimpur.

18. *Agricultural work on the Sadiya Frontier.*—Mr. M. Smith held the post of Agricultural Instructor throughout the period under report.

There are small experimental stations at Sadiya, Pasighat and Rotung. At Sadiya the area of land taken up is about 10 acres, of which 7½ acres is under cultivation, the main object being to demonstrate the cultivation of fruit, vegetables and other crops with a view to their introduction in the locality. The following crops were grown during the year :—

Hot weather vegetables.—Melons, gourds, ladies' fingers, etc. on about an acre of land did well and the produce was distributed to the patients at the local hospital.

Cold weather vegetables.—Cabbages, Cauliflowers, knol khols, peas, etc., were grown on an area of about 2 acres. The outturn was very satisfactory, and the sale proceeds amounted to Rs. 825 which was credited in the local treasury. Vegetable seedlings were also distributed to villagers in the locality.

Potatoes.—Two maunds of local seed and 4½ maunds of Shillong "seed" were planted. The outturn of the Shillong "seed" was 39½ maunds, and that of local "seed" just over 6 maunds, the Shillong potatoes proving about three times as prolific as the local variety.

Groundnuts—planted on about ½ acre in the old nursery yielded at the rate of 21 maunds per acre, which is a very satisfactory result. Five seers of seed was distributed in Poshin village by the "Gam" with good results.

Aus paddy—was sown on about 2 acres and gave a total outturn of no less than 63 maunds of grain equal to 31½ maunds per acre. This is about double the average yield for the province.

Wheat—Five seers was sown on ¼ acre, and yielded 2½ maunds, or at the rate of 10 maunds per acre. The outturn would have been greater had not part of the crop been destroyed by rats and birds.

Oats—did very well yielding 2 maunds 36 seers from ⅐th acre, or at the rate of over 20 maunds per acre.

Sugarcane.—Striped Mauritius, B. 376 and B 147 from the Jorhat farm occupied an area of about ¾ acre, and made good growth. Crushing and *gur* boiling were in progress at the end of the year, and the results will be recorded in next year's report.

Coffee—is being tried experimentally. The plants, which are still in the nursery, are making good progress.

Fruit.—Lichi, guava, peach, orange, lime and pomelo trees have been planted and are doing well. At present all the trees are very young and have not yet come into bearing.

At Pasighat a small garden about an acre in extent was opened during the year for the growth of vegetables. In this vicinity on 3½ acres of terrace cultivation a crop of over 100 maunds of paddy was obtained.

At Rotung 12½ acres of land have been terraced for wet rice. This work is supervised by two Angami Nagas who act as Instructors in the art of terracing. The outturn of paddy from this area was 480 maunds, or at the rate of over 38 maunds per acre—an exceptionally heavy yield.

For the improvement of the local cattle a bull from the Shillong farm is kept at Pasighat, and cattle owners are charged at the rate of Rs. 2-8 for his services. In this locality the Instructor castrated 62 weedy bulls during the cold weather. A few were castrated at Sadiya, but operations had to be stopped on the outbreak of foot-and-mouth disease.

19. *Agricultural work in the Garo Hills.*—The work in this district is in charge of one demonstrator, a Garo named H. M. Momin, who was formerly under the supervision of the Agricultural Inspector, Khasi and Jaintia Hills, but recently has been put under the Agricultural Inspector, Goalpara. He was on tour for 194 days.

The greater part of the district is hilly and cultivation is on the *jhum* system of mixed cropping. The principal crops are paddy and cotton.

"*Jhum*".—*paddy*—Demonstrations were carried out in 3 centres with Garo varieties and in 3 centres with Khasi varieties. The Khasi varieties failed. The Garo varieties gave an average outturn of 20⅓ maunds per acre.

Wet paddy.—Demonstrations were also carried out with Garo varieties in 3 centres and with Khasi varieties in 3 centres.

The Khasi varieties failed, and the Garo variety in one centre was destroyed by deer and wild pigs. The remaining two centres gave an average outturn of 31 maunds per acre of Garo paddy.

Potatoes.—Were demonstrated at 9 centres. Area of plots in 8 centres was $\frac{1}{10}$ acre and in 1 centre was $\frac{1}{5}$ acre. Thus the total area in all centres was 1 acre. The variety was King of Potatoes from Shillong, and the seed rate 10 maunds per acre. The outturn varied from 18¼ to 56½ maunds per acre, the average of the 9 centres being 42½ maunds per acre. The results are not good owing to late arrival of the seed.

Cotton.—Demonstrations in 3 centres with yellow cotton were unsuccesful owing to impure seed.

Groundnuts—were tried in two centres. In one centre where cowdung manure was applied the yield from $\frac{1}{20}$ acre was 10 seers, or at the rate of 5 maunds per acre. In the other centre where no manure was given the yield was 8 seers or at the rate of 4 maunds per acre. These yields are very poor, but the crop is reported to have been attacked by white ants.

Grafting and pruning of fruit trees.—Four mangoes were grafted, 86 oranges were pruned and 6 root pruned by the demonstrator.

20. *Distribution of seeds, implements, manures, etc., including the work of the Seed Depôt, Gauhati*.—This work was extended considerably during the period under report. With the exception of the distribution of sugarcane setts, which was undertaken by the District Agricultural Inspectors, the arrangements for the supply of seeds, manures and implements, etc., is undertaken by the Seed Depôt, Gauhati.

Sugarcane setts of the varieties Striped Mauritius, B. 376 and B. 147 were distributed from several centres in the Valley, the total number of setts dealt with being over 3½ lakhs. The

sources of supply and the number distributed in each locality are noted below :—

Source of supply.		Distribution.	
Kamrup farm	2,55,000	Kamrup	1,20,000
Jorhat „	61,000	Sibsagar	1,16,000
Sibsagar jail	12,000	Nowgong	55,000
„ cane-growing centres	5,000	Goalpara	23,000
Kamrup „ ...	32,000	Lakhimpur	12,000
		Surma Valley	42,000
Total ...	3,68,000	Total ...	3,68,000

In Kamrup the majority were sold at the rate of annas eight per hundred. In Goalpara 18,000 were sold. The remainder were distributed free for demonstration purposes and with a view to forming centres for next year's supply of setts.

The work of the Seed Depôt has expanded rapidly since the introduction of the system whereby sale proceeds are credited against expenditure.

During the 9 months covering the period under report the total quantity of seeds and manures issued was 970 maunds, value Rs. 4,855, while the number of implements, etc., was 78, value Rs. 3,792. Of these quantities, 724 maunds of seed, etc., value Rs. 3,599, and 62 implements, etc., value Rs. 3,140, were actually sold to the public and the receipts credited in the local treasury, the remainder being distributed free for demonstration purposes and to Government farms.

The quantity of manures supplied was practically negligible. Of seeds the chief amounts were 828 maunds of seed potatoes, value Rs. 3,867, of which 673½ maunds, value Rs. 3,095, were sold and the remainder used for demonstration purposes, 10¾ maunds jute, value Rs. 148, of which 4 maunds were sold and the remainder distributed free, and 25 maunds of oats, value Rs. 129, of which 17 maunds were sold. Of implements the main issues were iron sugarcane mills, of which 38, value Rs. 2,950, were actually sold and 6, value Rs. 480, were sent out for demonstration work.

Altogether 36 kinds of seeds, 3 kinds of manure, 4 kinds of implements (excluding spare parts) were dealt with during the year.

A promising new line of work was the sale of two-anna packets of Sutton's English vegetable seeds. These appear to have immediately secured popularity with the public, as the sale amounted to Rs. 135.

The accompanying statement shows the working of the Depôt for the year under report. The nett cost of the working of the Depôt allowing depreciation and increase of stock was Rs. 467.

A statement showing the working of the Gauhati Seed Depôt for the nine months ending 31st March 1919.

Assets or receipts.				Liabilities or charges.			
1				2			
	Rs.	a.	p.		Rs.	a.	p.
Total amount realised from sale in year under report (i.e.), from 1st July 1918 to 31st March 1919.	6,739	0	6	Rent	321	12	0
				Establishment	313	8	0
				Contingencies	685	7	0
Deduct outstanding of last year realised in year under report.	249	10	3				
				Depreciation in value of stock in hand at 10 per cent. of cost price.	36	4	0
Receipts of current year ...	6,489	6	3	Cost of purchasing stores ...	7,831	11	3
Add—				Cost of stores supplied free from farms, etc.	299	6	9
Bills outstanding	508	13	0	Cost of bills outstanding on account of stores purchased.	184	2	9
Value of stores supplied free to the Honorary Correspondents and farms and for demonstration purposes.	1,961	3	2				
					9,622	3	9
	8,959	6	5				
				Cost price of stock in hand on 1st July 1918.	172	6	9
Profit and loss account ...	466	12	1	Cost price of stock in hand on 31st March 1919.	368	7	9
Total ...	9,426	2	6	Increase in stock	196	1	3
				Total ...	9,426	2	6

21. *Work of Honorary Correspondents.*—There are 14 Honorary Correspondents in the Assam Valley and one in the Garo Hills.

Maulvi Taiyab Ali of Sonapur rendered much assistance to the Department by growing Indra *sail* paddy and Kakiya Bombai jute for seed. He supplied 8 maunds of jute seed to the Seed Depôt.

Srijut Pitambar Saikia of Kowang, Lakhimpur, is reported to have grown Garo cotton successfully on a large scale, and Maulvi Zubaid Ali Hazarika of North Lakhimpur made an experiment with Shillong varieties of potatoes.

A. G. BIRT,

Deputy Director of Agriculture, Assam Valley.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN THE SURMA VALLEY CIRCLE FOR NINE MONTH ENDING THE 31ST MARCH 1919.

The demonstration work was in charge of Srijut Laksheshwar Barthakur, Superintendent of Agriculture, until October 1918, when he was transferred to the Assam Valley, and replaced by Maulvi Fazlal Haq Ahmed. The former was on tour for 60 days and the latter for 152 days.

In addition to the district demonstration work, the Superintendent had charge of the recently established seed depôt, and of special work in connection with the destruction of Water Hyacinth in Habiganj.

Probably owing to these transfers, there were signs of some slackening of activity in the agricultural work. The seed depôt has now been established on a firm basis and the district work is going on satisfactorily. Separate notes on the demonstration work in Sylhet and in Cachar, on the Sylhet Seed Depôt, and on Water Hyacinth work are given.

Agricultural Demonstrations in Sylhet.

2. The district consists of the five subdivisions of North Sylhet South Sylhet, Habiganj, Karimganj and Sunamganj. No work has yet been attempted in Sunamganj. At the beginning of the period Karimganj formed part of the charge of Srijut L. M. Das and Babu Binode Bihari Das was in charge of the other three subdivisions. Consequent upon the transfer of the former in January and the appointment, at the same time, of Babu Trafulla Chandra Dutta as Agricultural Inspector, South Sylhet and Habiganj, Binode Babu's charge was altered to that of North Sylhet and Karimganj subdivisions.

The demonstration centres were distributed over all these subdivisions, and the Agricultural Inspectors were helped in the district work by five demonstrators with headquarters at Sylhet, Kulaura, Maulvi Bazar, Shaistaganj and Barlekha. The Agricultural Inspector, Sylhet, was somewhat handicapped in his district work on account of changes in his demonstration staff. The services of the Kulaura demonstrator had to be dispensed with at a time when he ought to have been engaged in organising cold-weather demonstrations. His successor died after only

a few week's work and it was some weeks before another man was available to fill the vacancy. Another demonstrator was absent for two months owing to the attack of influenza.

District work had to be largely held in abeyance in the early part of 1919 owing to the Agricultural Inspectors of Sylhet and Habiganj being put in charge of Water Hyacinth ash operations at Murakari and Bejura, respectively.

Babu B. B. Das was on tour for 186 days and Babu P. C. Dutta for 72 days from the time of his appointment to a separate charge in the middle of January.

3. The agricultural operations were continued along the same lines as in previous year and now consist of the following :—

(*a*) Paddy manurial tests.

(*b*) Trial with superior varieties of paddy.

(*c*) Introduction of superior sugarcane and 3-roller iron mills.

(*d*) Introduction of Shillong potatoes.

(*e*) Jute demonstrations.

(*f*) Trial with new crops :—Groundnuts, fodder crops, cereals, pulses and oilseeds.

(*g*) Miscellaneous :—Trials with Meston plough, conservation of cattle manure in covered pits or sheds.

Paddy manurial demonstrations laid down in 1918 consisted of the following :—(*a*) Bonemeal, (*b*) Bonemeal and dhaincha, (*c*) Limestone and dhaincha, (*d*) Bonemeal and oilcake, (*e*) Oilcake (*f*) Dhaincha green manure.

In North Sylhet the tests are discouraging, as they have not even gone so far as to return the bare cost of manuring. In South Sylhet the increased yields from bonemeal alone, bonemeal and oil cake, and Dhaincha green manuring were sufficient to leave a slight profit. In Karimganj the manures gave encouraging results, whereas in Habiganj the results were unsatisfactory. Bonemeal was applied at the rate of 247 pounds, ground limestone 823 pounds, oilcake 494 pounds and dhaincha seed

was sown at the rate of 30 pounds per acre. The yields from the various manures are shown in the accompanying abstract :—

Kind of treatment.	Number of tests.	Average in course in outlines.	Value of the increased crop at Rs. 2-8-0 per maund.	Cost of manuring.	Profit or loss.	Remarks.
1	2	3	4	5	6	7
			Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bonemeal	2	216	6 12 0	9 0 0	—2 4 0	North Sylhet.
Bonemeal and Dhaincha ...	2	182	5 11 0	10 12 0	—5 1 0	
Limestone and Dhaincha ...	2	145	4 8 0	11 12 0	—7 4 0	
Bonemeal and Oilcake	3	364	11 6 0	16 8 0	—5 2 0	
Oilcake	1	—289	—9 0 0	6 0 0	—15 0 0	
Bonemeal	3	1,031	10 5 0	9 0 0	1 5 0	South Sylhet.
Bonemeal and Dhaincha ...	2	179	5 9 0	10 12 0	—5 3 0	
Limestone and Dhaincha ...	2	118	4 11 0	11 12 0	—7 1 0	
Bonemeal and oilcake	4	451	14 1 0	10 8 0	3 9 0	
Oilcake	2	185	5 12 0	0 12 0	—6 4 0	
Dhaincha green manuring ...	1	189	5 14 0	1 12 0	4 2 0	
Bonemeal	9	162	8 3 0	9 0 0	—0 13 0	Karimganj.
Bonemeal and Dhaincha ...	1	—113	—7 1 0	10 8 0	—17 9 0	
Limestone and Dhaincha ...	1	—386	—12 1 0	11 12 0	—23 13 0	
Limestone and Bonemeal ...	1	659	20 9 0	19 0 0	1 7 0	
Oilcake	3	355	11 1 0	12 0 0	—0 15 0	
Bonemeal	3	152	4 12 0	9 0 0	—4 4 0	Habiganj.
Bonemeal and Dhaincha ...	3	446	13 15 0	10 12 0	3 3 0	
Limestone and Dhaincha ...	1	—102	—3 3 0	11 12 0	—14 15 0	
Bonemeal and oilcake	2	78	2 7 0	10 8 0	—8 1 0	
Dhaincha	2	222	6 15 0	1 12 0	5 3 0	
Oilcake	2	303	9 8 0	12 0 0	—3 8 0	

The above demonstrations were distributed over the following centres:—Dharmada, Baraya, Renga, Jalalpur, in North Sylhet, Langla, Maulvi Bazar, Balisira, Srimangal, Goyasnagar in South

Sylhet, Barleka, Chotalekha, Patharia, Shahbazpur, Fakinbazar, Gangajal in Karimganj, Shaistaganj, Narpati, Ramsiri, Satiyajuri, Surma, Taliapara in Habiganj.

4. The residual effect of bonemeal and dhaincha, bonemeal, bonemeal and oilcake and oilcake, etc., applied in 1917 were observed by weighing the crops produced in 1918 from the plots so treated.

The results over the two years will be found in the abstracts given below :—

Kind of treatment.	Number of demonstrations.	Average increase in 1918.	Average increase in previous year.	Total average increase.	Value of the total increase at Rs. 2-8-0 per maund.	Cost of manuring.	Profit and loss.	Remarks.
1	2	3	4	5	6	7	8	9
					Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bonemeal	6	100	456	556	17 6 0	9 0 0	8 6 0	
Bonemeal and Dhaincha ...	4	343	225	568	17 12 0	10 12 0	7 0 0	
Bonemeal and oilcake ...	2	—14	281	267	8 5 0	10 8 0	—(2 3 0)	
Oilcake	1	445	276	721	22 8 0	12 0 0	10 8 0	
Dhaincha	1	—3	328	325	10 2 0	1 12 0	8 6 0	
Bonemeal	3	67	426	493	15 6 0	9 0 0	6 6 0	
Oilcake	1	140	—97	43	1 6 0	12 0 0	—(10 10 0)	
Bonemeal and Dhaincha ...	1	292	282	574	17 15 0	10 12 0	7 3 0	
Bonemeal	5	396	726	1,122	35 1 0	9 0 0	28 1 0	
Bonemeal and Dhaincha ...	5	198	992	1,185	37 0 0	10 12 0	26 4 0	
Bonemeal and oilcake ...	1	525	512	1,037	32 6 0	10 8 0	21 14 0	
Bonemeal and limestone ...	1	229	643	872	27 4 0	19 0 0	8 4 0	
Oilcake	2	—55	75	25	0 12 0	12 0 0	—(12 4 0)	
Bonemeal and oilcake ...	1	77	611	688	21 8 0	10 8 0	11 0 0	
Bonemeal	1	—164	464	300	9 6 0	9 0 0	0 6 0	
Oilcake	1	248	333	581	18 2 0	12 0 0	6 2 0	

The above demonstrations were distributed over the following centres .—Sultanpur, Baraya, Gutatikar, Khitta, Tukerbazar, Dakhingach, Jalalpur in North Sylhet, Chhotalekha, Shahabazpur, Rajnagar in Karimganj, Shaistaganj in Habiganj.

The results for three years of manures applied in 1916 are given below :—

Kind of treatment.	Number of demonstrations.	Average increase in 1918.	Average increase in previous year.	Total average increase, 3 years.	Value of increase crop.	Cost of manuring.	Profit.	Remarks.
1	2	3	4	5	6	7	8	9
					Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bonemeal	7	186	796	982	30 11 0	9 0 0	21 11 0	
Bonemeal	7	424	974	1,398	44 11 0	9 0 0	35 11 0	
Bonemeal and Dhaincha ...	2	368	564	932	29 2 0	10 12 0	18 6 0	
Dhaincha...	2	734	261	995	31 1 0	1 12 0	29 5 0	

The above demonstrations were distributed over the following centres :—Ganganagar, Tuckerbazar and Chhotalekha in Karimganj.

5. With a view to introduce the superior varieties of paddy George and Indra sail, a number of demonstrations was arranged in the district. Unfortunately the selection of sites was in some cases defective, the germination of the seed in others was poor, and in other cases considerable damage was caused to the seedling by flood. The results are not so reliable as could have been desired, nevertheless Indra sail has shown an increase of 263 pounds per acre over the best local varieties.

6. For sugarcane the record is disappointing. This is due to the bad germination of the sets and the general unsuitable character of the rainy season which admitted of no proper cultivation. Although 42 demonstrations were laid down and although few of them were really satisfactory, the canes are much appreciated by the cultivators and there is a considerable demand for further supplies from the districts where satisfactory crops

were grown. The three-roller iron mills was demonstrated successfully in the subdivisions of Karimganj, South Sylhet, Habiganj; as a result six mills were sold and more could have been disposed of had they been available in time. The results of crushing demonstrations given at various centres near Bhanugach, Manu, Chhotalekha, Ramchandrapur, and Shaistaganj showed that on the average 10 to 15 per cent. greater extraction of juice was possible than with the wooden mills.

7. *Introduction of Shillong potatoes.*—With a view to introduce superior varieties of Shillong potatoes and at the same time to test big sized seeds against small sized ones, a number of demonstrations was organised and some 40 maunds of seed potatoes were distributed for the purpose. The results are tabulated below :—

Nature of tests.	Number of tests.	Yield per acre.		Yield per acre, Shillong varieties.		Remarks.
		Shillong.	Country.	Big sized.	Small sized.	
1	2	3	4	5	6	7
Variety ...	3	6,836	6,493	...	...	North Sylhet.
Size tests ...	2	...	...	11,265	8,428	
Variety ...	7	5,601	5,639	...	...	South Sylhet.
Size tests ...	4	...	...	10,992	9,755	
Variety ...	6	4,232	2,240	...	...	Karimganj.
Size tests ...	4	...	...	5,997	5,995	
Variety ...	3	4,260	3,747	...	...	Habiganj.
Size tests ...	2	...	...	11,472	9,089	
Average ...	...	5,232	4,530	9,931	8,316	for the whole district.

From the above figures it is apparent that the Shillong potatoes are much better croppers than the country or Bholaganj potatoes and that the big sized seeds are more economical than small ones.

8. *Jute demonstrations.*—Kakaya Bombai jute of the Bengal Agricultural Department was introduced in Sylhet in the year 1916 and since then it has been rising in general popularity throughout the district. Results of variety and manurial tests organized in 1918 are to be seen below. In addition a number of small packets was distributed free for popularising this variety among cultivators who had no previous experience of it, but unfortunately most of the crops were spoiled by the heavy flood.

Kind of demonstration.	Average number of demonstrations.	Average increase over the country variety.	Average increase over the untreated plots in pounds per acre.	Remarks.
1	2	3	4	5
Variety	2	710	...	North Sylhet.
Bonemeal manured ...	2	...	189	
Variety	2	425	...	
Bonemeal	2	...	166	Habiganj.
Water Hyacinth ash ...	2	...	144	
Bonemeal and hyacinth...	1	...	256	

As the cost of the manures used was Rs. 10 per acre and the average value of the extra crop produced was about Rs. 20, these may be looked upon as satisfactory, especially as some residual value of the manures will remain behind.

9. *Trials with new crops.*—Groundnuts were tried at 44 centres throughout the district. At 30 of these centres, though the crops grew very luxuriantly at the beginning, they succumbed later to heavy rains. The average outturn per acre from the plants which completed their growth properly was 1,002lbs. and the average seed rate was 50lbs.

The season for cold-weather demonstration in general was very unfavourable, owing to the fact that the rains continued late. Moreover the unusually long drought that followed soon after sowing prevented satisfactory growth of these crops.

The results of a few of the more satisfactory tests are gi en below :—

Name of crops.	Seed rate.	Yield obtained.	Remarks.
1	2	3	4
	lbs.	lbs.	
Wheat	146	2,113	
Barley	146	1,995	
Khesari	33	290	
Masuri	29	419	

Assam mustard, large grained linseed from Calcutta and Bhengi, tobacco from Rangpur, were tried against the local varieties.

Name of crop.	Increase over the local variety, in pound, per acre.
Assam mustard	103
Calcutta linseed	47
Rangpur tobacco	70

(The results of three tobacco plots are not yet available, as the leaves are still in the process of curing).

Gandhi sail, a very late variety of s il from the Mymensingh district, was tried with success and the yield per acre was 984 lbs.

10. *Miscellaneous.*—The use of the Meston plough was demonstrated on jute areas and tried on potato plots in North and South Sylhet and Karimganj. Several cultivators have promised to purchase next year, but no sales have yet been made, probably owing to the high price of these ploughs as compared with local ploughs.

Manure pits and sheds erected in the several subdivisions are shown below :—

Karimganj	3
North Sylhet	4
S uth Sylhet	3
H biganj	8

This important work is not being carried out so energetically as it might be and greater attention must be devoted to it in future.

11. The Agricultural demonstrators at Barleka, Sylhet, Shaistaganj and Maulvi Bazar were on tour for 122, 138, 85 and 144 days, respectively. These demonstrators have worked well. The death of Demonstrator Sanat Kumar De is deeply regretted, as during his short term of service in Kulaura circle, he had proved most promising.

12. Agricultural Inspector Babu Benode Behari Das worked satisfactorily under somewhat difficult circumstances.

Agricultural Inspector Babu Profulla Chandra Dutta shows energy and intelligence and is a promising officer.

Agricultural Demonstrations in Cachar Plains.

13. Agricultural Inspector Srijut Lalit Mohan Das was in charge of the demonstration work in the Cachar plains till early in January 1919 when on his transfer to the Assam Valley charge was taken over by Babu Kamini Kumar De.

During the greater part of the period there was only one demonstrator to assist in the work, but towards the end of it a second man was appointed, and the district divided into the two circles, Silchar and Hailakandi.

The Agricultural Inspector Srijut Lalit Mohan Das was on tour for 125 days, Agricultural Inspector Babu Kamini Kumar De for 52 days from the time he took over charge in January, and the demonstrator for 242 days for the period under report.

14. Kinds of demonstrations—

(*a*) Paddy manurial tests.

(*b*) Trial with superior varieties of paddy.

(*c*) Introduction of superior varieties of sugarcane and 3 roller iron mills.

(*d*) Introduction of Shillong potatoes.

(*e*) Trials with new crops :—

Groundnuts, jute, cereals, pulses and oilseeds.

(*f*) Miscellaneous—Trials with Meston plough, conservation of cattle manure in covered pits in sheds.

15. Paddy manurial demonstrations laid down in 1918 comprised :—

(*a*) Bonemeal used alone, (*b*) Bonemeal with ground limestone, (*c*) Dhaincha green manuring, and (*d*) Dhaincha with ground limestone.

Except on one or two cases the paddy manurial tests on *ekfasl* land have not shown any appreciable results, and those which did so are not very convincing.

16. On the whole on *dofasl* lands the results are good.

Bonemeal was applied at the rate of 3 maunds (247 pounds), limestone 10 maunds (823 pounds) and dhaincha seed sown at the rate of 30 pounds per acre.

The average yields from each kind of treatment and the costs thereof are given in the following abstract :—

Treatment.	Number of demonstrations.	Average increase in outturn.	Value of the increased crop at Rs. 2-8-0 per maund.	Cost of manuring.	Profit or loss.	Remarks.
1	2	3	4	5	6	7
			Rs. a. p.	Rs. a. p.	Rs. a. p.	
Bonemeal ...	5	339	10 5 0	9 0 0	1 5 0	Ekfasl land.
	4	888	27 1 0	9 0 0	18 1 0	Dofasl ,,
Bonemeal and limestone ...	2	727	22 3 0	19 0 0	3 3 0	
Dhaincha green manuring ...	3	354	10 12 0	1 12 0	9 0 0	
Dhaincha and limestone ...	1	76	2 2 0	11 12 0	9 10 0	

The above demonstrations were distributed over the following centres :—Banskandi and Lakhirband in Hailakandi and Ramnagar, Topekhana, Joynagar and Kashipur in Silchar.

17. The residual effect of bonemeal, bonemeal and dhaincha, and dhaincha green manuring applied in 1917 were observed by weighing the crops produced in 1918 from the plots so treated. The results will be found in the abstract given below :—

Details of demonstration.	Increase in 1918.	Increase in 1917.	Total increase.	Value of total increase at Rs. 3-8-0 per maund.	Cost of manuring.	Remarks.
	In pounds per acre.					
1	2	3	4	5	6	7
				Rs. a. p.	Rs. a. p.	
Average of bonemeal demonstration.	434	594	1,028	31 5 0	9 0 0	
Average of dhaincha green manuring demonstration.	611	531	1,142	34 13 0	1 12 0	
Average of bonemeal and dhaincha demonstration.	453	268	721	22 0 0	10 12 0	

The above demonstrations were distributed over the following centres :—Lakhirband, Boolipar, Banskandi and Lakhipur and the results are quite satisfactory.

18. With a view to introduce superior varieties of paddy, a number of trials was carried out at various centres. George *sail* introduced by Srijut N. C. Barua, Honorary correspondent of the Department, and Indra *sail* by the Bengal Department were tried against the best local varieties. As the crops were planted at different times and somewhat late in the season and as the earlier planted crops were damaged by flood, the figures have little experimental value. With a larger staff and closer supervision more decisive results should be obtained in the present year from the large number of demonstrations which are now being organised.

19. In sugarcane the record is poor and discouraging. Out of 30 demonstration plots only a half dozen can show some trace of the superior varieties. Sugarcane in general suffered greatly from the continuous and excessive rain after planting and it is generally reported that no after cultivation was possible. Under the circumstances it is expected that not more than 100 or 200 sets will be returned instead of a number equal to that supplied last year. In spite of the many difficulties, it is pleasing to

observe that where these canes were once introduced, they have established their superiority over the local varieties. Arrangements have been made to distribute a further supply of sets from the Assam Valley, and it is hoped that next year there will be sufficient sets available for future distribution from those now introduced.

The three-roller iron mills was demonstrated with some success at several centres. The fact that there are already two roller iron mills in the district makes it more difficult to introduce the three-roller mills, especially at the present price of Rs. 80 or over.

20. *Introduction of Shillong potatoes.*—With a view to introduce superior varieties of Shillong potatoes and at the same time to test big sized sets against small sized sets, a number of demonstration was organized at various centres, and some 30 maunds of seed potatoes were distributed for the purpose.

The results of these tests are given below :—

Nature of tests.	Number of test.	Yield per acre, in pound.		Yield per acre, in pound, Shillong varieties.		Remarks.
		Shillong.	Country.	Big sized seeds.	Small sized seeds.	
1	2	3	4	5	6	7
Tests ...	5	3,429	3,460	...	...	An average outturn of 40 maunds to the acre of the Shillong varieties is very poor.
Size tests ...	3	...	...	3,898	2,505	

From the above it can be seen that the introduced varieties have proved no better than the local variety. The reason probably is that as the former have larger tops and broader leaves, they get rid of more moisture by transpiration and so suffer to a much greater extent from the drought than the smaller leaved and hardier local varieties, especially as irrigation is little practised.

The size tests clearly indicate that it is poor economy to plant very much small sized sets, as is the common practice with the cultivators of the province.

21. Trials with new crops :—

(*a*) *Fodder*.—Jawar was tried, but on account of heavy rain following immediately after sowing, the seeds failed to germinate.

(*b*) Groundnuts were tried at a number of places, but many of the plots suffered from water-logging, and some from disease. These grown on highlands in Hailakandi and at Katigara did much better and gave very profitable crops. Winter crops were unsatisfactory in most cases ; the average yields obtained from seeds sown at different places are shown below :—

Name of crop.	Seed sown.	Yield obtained.
	Pounds.	Pounds.
Wheat	22	110
Barley	4	20
Oats	2	8
Khesari	41	103
Masuri	4	40
Assam mustard	4	41

The results of the Assam mustard are encouraging and the tests will be repeated.

Large grained linseed obtained from Calcutta has not shown any superiority over the local smaller grained variety.

The demonstrators appear to have made few, if any, attempts either to introduce the Meston plough or to induce the cultivators to prepare covered manured pits or sheds. These matters must receive more attention in future.

The Agricultural Inspector purchased and supplied seven gur boiling pans to the Assam Valley at an average price of Rs. 26 each.

The Agricultural Demonstrator Munshi Ajrumand Ali worked well.

REPORT ON THE SYLHET SEED DEPÔT FOR THE YEAR ENDING 31ST MARCH 1919.

22. The seed depôt is accommodated in a corrugated iron building which is situated on the south bank of the Surma river, close to the Sylhet ghat railway station. The situation is an excellent one, but it is possible that the building will prove too small as the work develops.

The Superintendent of Agriculture, Surma Valley, is in charge of the seed depôt and is assisted by a clerk. A chaukidar is also employed. He lives in quarters attached to the building.

Maulvi Fazlal Haq Ahmed took over charge from October 1918 on his transfer as Superintendent, Surma Valley. Although the building was rented and preliminary arrangements were made from June, no actual business transactions took place until October. In the six months ending 31st March 1919, seeds, manures and implements to the value of approximately Rs. 5,500 were dealt with. The most important items were Shillong seed potatoes 194 maunds, pulse seed 56 maunds, linseed and other oilseeds 50 maunds, paddy 24 maunds, jute seed 13½ maunds, cereals and miscellaneous seeds about 5 maunds, bonemeal sold in the Khasi and Jaintia Hills 570 maunds, other manures about 10 maunds, iron sugarcane mills seven. Out of 194 maunds of Shillong seed potatoes, 93 maunds 35 seers were sold to the public at Rs. 4-14-0 per maund including price of sacks, producing a sum of Rs. 457-8-6, 15 maunds worth Rs. 71-4-0 were sold to Honorary Correspondents at half price, 64 maunds worth Rs. 304 were used for demonstration purposes, and the balance of about 21 maunds was lost through dryage, rottage and difference on reweighment. The total value of potatoes thus disposed of comes to Rs. 832-12-6, while the total cost was Rs. 828-7-3. The percentage of loss is somewhat heavy, but it is hoped that this loss may be avoided in future by better arrangements for smaller consignments and prompt distribution.

The circular on the cultivation of pulse crop issued by the Agricultural Department towards the end of the rains of 1918 created considerable interest, with the result that there was a demand for such seeds from every part of the valley. Khesari and masuri were most in demand, 23½ maunds of the former and 25½ maunds of the latter were sold for seed purposes, and a small balance of 5¾ maunds were sold as dal. The seeds were first class and germinated well, but on account of excessive drought the crop in many cases failed to produce seed.

The linseed was supplied to the order of the Deputy Commissioner for flood relief cultivation in the Kanairghat district.

Arrangements were made through the seed depôt for the supply of 1,450 maunds of bonemeal to the Khasi and Jaintia Hills. A total quantity of 570 maunds was sold up to the close of the year. The price realised up to the end of the year was Rs. 2,416-6-4 and the greater part of the balance has since been disposed of. The sale prices have been fixed at Rs. 4-2-0 and

Rs. 5-6-0 per maund at Shillong and Jowai, respectively, which is only very slightly more than the cost of delivering the manure to the cultivators.

The fact that the staff knew little of the district or of the work, made the establishment of the depôt somewhat difficult, but notwithstanding these difficulties good start has been made in the six months during which business has been carried on.

The accompanying balance-sheet shew a loss of Rs. 2,195-2-4, but the greater part of this apparent loss is made up of capital expenditure on the purchase of furniture and fittings and of the carriage paid on them. The remainder of the loss is due to the fact that it was found necessary to stock small quantities of various seeds which had to be procured from long distances and on which passenger freight rates had frequently to be paid and that these seeds were supplied at unremunerative rates.

Statement showing the working of the Sylhet Seed Depôt for the year ending 31st March 1919.

Assets or receipts.		Liabilities or charges.	
1	2	3	4
	Rs. a. p.		Rs. a. p.
Total amount realized from sale in year under report.	3,566 0 10	Rent	225 0 0
		Establishment ...	204 7 0
Add bills outstanding	359 12 9	Furniture	1,298 9 6
		Contingencies ...	1,173 5 6
Value of stores supplied free or at concession rates to Honorary Correspondents and farms and for demonstration purposes.	1,446 4 5	Depreciation in value of stock in hand at 10 per cent. of cost price.	129 15 7
		Cost of purchasing stores	5,240 15 4
		Cost of stores supplied free from farms, etc.	594 11 4
	5,372 2 0		8,867 0 3
Profit and Loss Account...	2,195 2 4	Cost price of stock in hand on 1st July 1919.	Nil.
		Cost price of stock in hand on 31st March 1919.	1,299 11 11
Total ...	7,567 4 4	Total ...	7,567 4 4

23. *Water Hyacinth.*—This pest continues to spread in the low-lying district of the Surma Valley, where it appears to have established itself four of five years ago. It may have arrived there earlier but does not appear to have been definitely recognized until about the time mentioned.

With a view to checking the spread of the weed, experimental work was started in the previous year and continued in the present one, the object being primarily to destroy the weed and at the same time to find out something of the value of the ash as manure, and to gain information as to the probable cost of the work of eradication. In the cold weather of 1917-18 a small quantity of ash was prepared which on analyses showed from 9 per cent. to 12 per cent. of potash. Part of this ash was sent to tea planters, and was applied by them to green manure crops grown among tea. Another portion was used for experimental manuring of jute, and the remainder was sent to a Calcutta merchant. The material gave good results on green manure crops and on jute, but the Calcutta firm reported that they could not utilize this low grade material in their preparations. As this ash contained potash almost equal in quantity to Kainit, one of the German potash manures which had an extensive sale in European countries in pre-war times, it was thought that something might be done towards utilizing the ash on a considerable scale within the province, and accordingly the work was continued in the past cold weather 1918-1919. A total quantity of 678 maunds of ash was prepared. Somewhat less than one-third of this was produced under the direct orders and supervision of our agricultural officers and the balance by two landowners of Chhatian in Habiganj subdivision. Arrangements were entered into with several tea planters in both the Surma and Assam Valleys to purchase the material at a price based on the potash content as shown by analysis. The Traffic Manager of the Assam-Bengal Railway was approached and was good enough to give specially low freight rates for its transport. Samples were taken by a responsible agricultural officer, as the material was filled in the railway wagons, and these samples were analysed by the Agricultural Chemist to the Assam Administration. The figures supplied by him are now to hand and have been found so low 3¾ per cent. to 6 per cent., as to preclude any possibility of local landowners or cultivators finding the preparation and supply of the ash a profitable business, unless as part of a scheme for clearing the lands and water courses of the district. From the planters' point of view also, it will be unprofitable to purchase and pay handling and freight charges on such low grade material.

The average cost of preparing the ash under departmental supervision, where all labour had to be paid at current rates, was Re. 1-9 per maund, while when done by the landowners or rather by their cultivators, the cost is reported to have been about twelve annas per maund. In the latter case much of the work of collecting the weeds was done free by the cultivators when preparing the lands for ploughing, while in the former the weeds were removed from tanks and water courses, often to a considerable distance, and dried and burned by paid labour. The average cost of preparing and delivering to the purchasers this total quantity of 678 maunds handled was Re. 1-10 per maund, while the average price realized will only amount to Re. 1-1 per maund.

Inquiries were made on the spot regarding the methods adopted by the Bengal Department to prepare a concentrated potash salt from the ash of the water hyacinth weed, and it was found that the financial return was only about half of the expenditure when this method is adopted. From the foregoing it will be seen that, even under the most favourable conditions of marketing and transport, it will not be possible either to produce an ash of commercial value or to prepare a concentrated salt without spending considerably more than the value of the produce and that if eradication is ever to be attempted, it must be on other than a direct profit paying basis. In the infested tracts large quantities of the weed are used for fuel : during flood time when foodder is scarce or non-existent green weeds are used, one can hardly say, for fodder—but for keeping the cattle alive. Weeds which have to be removed from lowlying lands to permit of cultivation are generally burned and the ash used as a manure. As a result of departmental interest in the question, the use of the ash or of the rotted plants as manure is spreading widely in infested tracts with the result that the spread of the weeds is being checked to some extent.

Work done by Honorary Correspondents.—Mr. D. Ferguson of Dhamai tried Kakaya Bombai jute of which he produced an excellent crop. The crop was kept for seed, and the seed has since been distributed among cultivators in his area. He also tried hyacinth ash as a manure and cold-weather fodder crops of oats, peas, etc., and reports that fodder crops were a failure owing to the extremely dry cold weather.

Babu Joynath Nandi of Bajura gave the Agricultural officers great assistance in hyacinth ash work. He distributed Shillong seed potatoes among his raiyats and neighbours and tried several pulse crops in the cold weather with a certain amount of success.

AGRICULTURAL DEMONSTRATIONS IN THE KHASI, AND JAINTIA HILLS DISTRICTS.

24. U Harry Singh was in charge of demonstration work in the hills until the end of December 1918. During the greater part of that time Mr L. L. Reade was under training with him, and he took over full charge from the former on 1st January 1919. When the transfer was made, U Harry Singh took over charge of the Upper Shillong Farm for two months while the Farm Manager was on leave and completing that duty he was appointed to the newly created post of Fruit Inspector for Assam. During the period under report U Harry Singh was on tour 107 days, most of which was in connection with his duties as Agricultural Inspector. Mr. Reade was on tour for a total of 115 days from the date of his appointment on 20th July 1918. During his period of training the greater part of his attention was taken up with the purchase and despatch of seed potatoes to the plains districts and, after his appointment, he had to spend a good deal of time in connection with the distribution of one thousand maunds of bonemeal most of which he succeeded in selling to Khasi cultivators before the end of the period. Assistance in demonstration work is given by four demonstrators headquartered at Shillong, Mawphlang, Umran and Jowai, respectively.

25. *Rice.*—The majority of rice-growers in the more conveniently situated tracts have realised the value of bonemeal for wet-land paddy. Fresh demonstrations have therefore been carried out in more remote places : altogether demonstrations were arranged in 8 centres as compared with 2 in the previous year. As in previous years two plots, each about $\frac{3}{4}$ acre in area were taken in each centre. One was manured with bonemeal at the rate of 3 maunds (247 lbs.) per acre, and the other left untreated as a check.

The first year's results are given in the following table :—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre.	Remarks.
			Bonemeal plot.	Untreated plot.		
1	2	3	4	5	6	7
1	Barapani ...	D. Bopmay ...	1,599	738	861	
2	Umpih ...	Willing ...	1,353	1,119	234	
3	Mawshn	Ka Kyriup ...	1,254	1,047	207	

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lb. per acre.	Remarks.
			Bonemeal plot.	Untreated plot.		
1	2	3	4	5	6	7
4	Nongkhlaw ...	Sumar ...	1,527	1,056	471	
5	Sohshrieh ...	Rang Museek ...	1,695	820	875	
6	Jarain ...	Kat Ling ...	984	738	246	
7	Lyngkien ...	Kit-n	1,793	1,394	399	
8	Pynthorumkhrah...	Kpa U Koid ...	...	...	...	The owner was unable to look after his field through illness (Influenza) and the crop was destroyed by cattle.
	Average yield per acre		1,458	937	470	

The average increase in crop due to bonemeal is, therefore, 470 lbs. per acre. Valuing this grain at Rs. 4 per maund of 82·3 lbs. and the bonemeal at Rs. 4-12-0, the net profit per acre works out at Rs. 8-9-6 for the first year of application. Any increase obtained in subsequent years will be pure profit, and experience shows that bonemeal favourably affects the crop for at least three years. These plots are being kept under observation as to the second and third years' results of the initial dressing of bonemeal.

Second year demonstrations.—The two demonstrations laid down in 1917, of which the first year's result appeared in last year's report, were kept under observation without further manuring, and the results of the second year appear below .—

No.	Locality.	Cultivators.	Yield of grain in lb. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mynthloo ...	Sahmaji ...	1,248	682	566
2	Pamra ..	My'lon Dykhar ..	1,586	828	758
		Average yield per acre.	1,417	755	662

This average increase of 662 lbs. is worth Rs. 32-2-9 at current prices.

These demonstrations yielded an average net profit of Rs. 2-14-9 per acre in the first year, after charging the entire cost of bonemeal to that year. The total net profit per acre from the first two years of this series of the demonstrations, therefore, averages Rs. 35-1-6.

Third year demonstrations.—The 5 centres commenced in 1916, of which the first and second year's results appeared in the reports for 1917 and 1918, were kept under observation for the third year. The demonstration plot in one centre was not cultivated through the owner's illness. The following yields were obtained from the remaining four demonstrations :—

No.	Locality	Cultivators.	Yield of grain per acre.		Increase in lb. per acre.	Remarks.
			Bonemeal plot.	Untreated plot.		
1	2	3	4	5	6	7
1	Nongthymmai...	U Noni ...	1,031	862	169	
2	Lumpengdeng ...	U Hinmoney ...	...	...	...	Not cultivated through illness.
3	Mawthoh ...	U Khai ...	1,626	1,426	200	
4	Um-iap	Ka Nesi ...	1,102	1,017	85	
5	Myriaw... ...	Siem Myriaw..	1,035	951	84	
		Average yield per acre.	1,198	1,064	134	

These four centres show an average increase of 134 lbs. of grain from the plots manured with bonemeal. This at current rates is worth Rs. 6-8-7. These centres showed an average net profit per acre of Rs. 14-5-5 for the first two years. The total net profit for the three years for which these demonstrations have been carried on is, therefore, Rs. 20-13-0, on an initial expenditure of Rs. 13-8-0 per acre.

During the year fresh demonstrations with bonemeal for upland paddy have been carried out in 12 centres, 4 centres in each of Shillong, Mawphlang and Jowai circles. The selected plots were as nearly as possible $\frac{1}{6}$th acre each. One plot was manured with bonemeal at the rate of 3 maunds = 247 lbs. per acre and another was left untreated for comparison.

The first year's results are given in the following table :—

No.	Locality.	Cultivators.	Yield of grains in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Umlyngka ...	U Sngap ...	960	906	54
2	Nongmasi ...	U Sad ...	1,440	1,280	160
3	Mawdatbaki ...	U Drain ...	656	525	131
4	Umjajew ...	U Soh ...	991	910	81
5	Rangshken ...	Ka Li ...	873	786	87
6	Sohiong ...	U Hirshon ...	1,026	913	113
7	Nongrimsa'ew ...	Ka Lili ...	1 120	886	234
8	Mawlong ...	Ka En ...	1,106	853	253
9	Jowai	U Thule ...	352	320	32
10	Wahjajer ...	U Ien ...	1,424	1,280	144
11	Nongbah ...	U Khiaw ...	480	400	80
12	Mawpyut ..	U Sfait ...	256	240	16
		Average yield per acre.	890	775	115

The effect of bonemeal on dry land paddy is not so marked as it is in the case of wet-land paddy. From the average results obtained in these 12 demonstrations it will be seen that 247 lbs. of bonemeal has produced an extra crop of 115 lbs. of grain. This is not sufficient to pay the initial cost of manure, and the

results of some of the second year's demonstrations which are now recorded also show a very small increase.

Second year demonstration.—The 12 centres commenced in 1918, of which the first year's results appeared in the report of last year, were kept under observation for the second year.

At five centres the owners of the lands on which demonstrations were made were unwilling to continue the demonstrations, as little effect was seen on the first crop. One demonstration at Pynthorlangtein was damaged by rain and the results thereof were not recorded. The results obtained from the remaining six centres for the second year are given in the following table :—

No.	Locality.	Cultivators.	Yield of grains in lb. per acre.		Increase in lbs. per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Umlyngka ...	U Thon ...	658	518	140
2	Umlane ...	U Sing ...	500	303	197
3	Talong ...	U Tata ...	450	302	148
4	Shymang ...	U Suna ...	410	209	201
5	Rymbai ...	U Doloi ...	510	266	244
6	Mawstem ...	Ka Bi ...	686	510	176
7	Pynthorlang'ein ...	U Dabid ...	...	...	Damaged by rain.
		Average yield per acre.	535	351	184

From the above figures and taking the average results obtained from the demonstrations for the first and second year it will be found that 217 lbs. of bonemeal produced an extra crop of 325 lbs. of grain, which is worth about Rs. 14 at the average rates. This leaves a small profit of about 0-8-0 (eight annas only) on an initial expenditure of Rs. 13-8-0 per acre. The results obtained are not so marked as to encourage the cultivators to to use the manure, and to continue the demonstrations on the same lands.

Third year demonstrations.—Only three out of the seven cultivators with whom these demonstrations were laid down in 1918

could be persuaded to continue the demonstrations for the third year, and the results obtained from the 3 centres are given in the following table :—

No.	Locality.	Cultivators.	Yield of grains in lbs. per acre.		Increase in lbs per acre.
			Bonemeal plot.	Untreated plot.	
1	2	3	4	5	6
1	Mylliem ...	U Tim ...	319	309	10
2	Umjajao ...	U Hon ...	358	298	60
3	Langlibun ...	U Sahon ...	415	300	115
		Average yield per acre.	364	392	62

From the above figures and taking the average yield of 351 lbs. obtained for the first and second years the total extra crop comes to 413 lbs. of grain, produced from the plots manured with bonemeal three years ago. This at the average rates for three years is worth Rs. 16-10-8, on an initial expenditure of Rs. 13-8-0, leaving a net profit of Rs. 3-2-8 only after the third year crop.

Judging from the figures above and the experiences of our demonstration staff during the three years it has to be admitted that the increase of crop due to bonemeal in the three years is not of a sufficiently high order to encourage the cultivator to use manure for upland paddy.

With the object of trying to improve the outturn of upland paddy in the districts, it is proposed to take up demonstrations with bonemeal and a soluble Nitrogenous manure in the present year.

At one centre in each of Shillong, Mawphlang and Jowai circles, a former wetland paddy demonstration was redressed with bonemeal. These domonstration plots were manured with bonemeal in 1914 and received no manure in the intervening years. The effect of this second dressing of bonemeal on the third year's crop will be seen from the accompanying table.

No.	Locality.	Cultivators.	Yield of grains in lbs. per acre.		Increase in lbs. per acre.
			Bonemeal plots.	Untreated plots.	
1	2	3	4	5	6
1	Shangpung ...	Smon Dhar ...	1,019	757	262
2	Umlyngka ...	Kpa Ka Kwai ...	1,690	1,430	260
3	Mairang ...	Kmie Ka Selina ...	1,189	885	304
	Average		1,299	1,024	275

These results indicate that a second dressing of bonemeal applied three years after the first dressing gives a profitable return. The average total increase obtained in the first and second and the third year was 1,022 lbs. Valuing the grain at the average rates Rs. 3-5-4 per maund and the bonemeal at Rs. 4-8-0 the net profit per acre works out at Rs. 29-1-4.

26. *Bone-crushing operations and bonemeal distribution.*—The total receipt of raw bones during the year was 1·37 tons. A consignment of 1,450 maunds=53·3 tons of bonemeal was purchased in Calcutta for the hills. About half of this was sold up to the end of the period under report, the greater part of the balance has since been sold and it is expected that the whole consignment will be disposed of in the course of a very short time. The demand is exceptionally keen from Shillong, Mawphlang and Jowai circles, and a much larger quantity could have been sold in the present year had it been available.

27. *Potato growing.*—During the year under report seed potatoes were distributed as follows:—

	Tons.	
From Ladmawphlang depôt ...	·29	For the Hill districts.
„ Shillong „ ...	·18	
„ Upper Shillong Farm (on return system) ...	5·79	
For Brahmaputra Valley ...	28·71	For the plain districts.
„ Surma „ ...	7·18	
Total ...	42·15=1,150 maunds.	

Demonstrations for winter potatoes were carried out in five centres in the Umran circle, where practically no summer crop is cultivated. One maund of seed was planted at each centre with the following results :—

No.	Locality.	Name of cultivators.	Yield in lbs. per 1 md. seed.	Remarks.
1	2	3	4	5
1	Umsning ...	Kpa ka Le ...	248	
2	Umran ...	„ Bar ...	...	Damaged by frost.
3	Umsaw ...	„ Hom ...	186	
4	Nong Khyllem ...	„ Bedi ...	168	The crop was attacked by ants.
5	Nongpoh ...	Basir Ahmed ...	320 lbs.	

During the year the frost was exceptionally heavy in the Bhoi country damaging the potato crop demonstrated at Umran. The results from the remaining 4 centres are promising. The demonstrations are being continued in the present year.

Spraying with Bordeaux mixture.— Owing to the extremely high price of materials no demonstrations were carried out in the past season. It is proposed to take up the work again when prices become more normal.

28. *Ploughing demonstrations.*—Ploughing demonstrations with the Meston plough were carried out in five centres at Mylliem, Barapani, Mawphlang, Umran and Jowai.

The plough is too light for dry land cultivation, but it is found more useful for wet cultivation than the country plough. The demonstration with the improved plough will be continued. Requisitions for the purchase of these ploughs are being received.

29. *Insect-pests.*—Rice pests, *viz.*, rice-case worms appeared in the district during the year. Remedial measures were taken by our staff and the ravages of these pests were successfully checked at three centres by the following means :—The water in the affected field was covered with a film of kerosine oil and the insects were then disturbed by drawing a rope across the affected plots. When so disturbed these insects drop into the water and are quickly killed by the kerosine oil.

30. *Grafting and pruning of fruit trees.*—This work was ontinued as in the previous years, demonstrations being given

by demonstrators from time to time on their tours. The following grafts were made in 16 villages :—

Oranges	Budded ...	272
Peaches	„	148
Pears	Grafted ...	114
Apples	„	10
Plums	„	128
Apricots	„	71
	Total ...	743

Up to the present no signs of disease have appeared on the oranges so budded.

The following plants are being prepared at the Wahjain Tropical Plantation :—

Jamaica oranges	5
Natal „	3
Lichis	6
Mangoes	6
Cashew nuts	6
Total	26

Pruning of fruit trees was done in 24 gardens, including 11 in Shillong circle, 2 in each of Mawplang and Umran circles and 3 in Jowai.

31. *Supply of seeds, plants, etc.*—The following seeds, plants etc., were distributed during the year :—

Plants :—

Pear grafts	43
Rhubarb Crowns	12
Asparagus „	12
Cryptomeria seedlings	437
Cofee	1,100
Pine apple suckers	1,800

Cuttings :—

Round pepper	162
Long pepper	162
Peaches	100
Pears	276
Grape vines	12
Figs	5

Seeds :—

Perilla Ocimoides	7½ lbs.
Buckwheat	78 „
Squash seeds	8 No.
Coffee seeds	20½ lbs.
Soy bean seeds	4 „
Sohphlang	10 „
Varieties of Arum (Ka shriew)	40 „
„ millets	3 „
„ job's tears	2 „
Vegetable seeds	200 packets.
Arrow root „	1 lbs.
Orange seeds	1 bl.
Garo Cotton	12 lbs.
Paddy seeds (from Mawsiat Khnam) ...	10 „

The following tools were supplied during the year :—

Secateurs	6
Fork	1

32. *Pan disease.*—The Imperial Bacteriologist, Pusa, visited Shillong and Cherrapoonji in the year before last and procured diseased specimens of plants for investigations but no report has yet been received.

33. The following Botanical specimens were supplied during the year :—

Plants of ksetpharai (Nepenthes Khasiana).

Ditto Sohlang thrait (Ganeltheri Fragrantis Sima).

34. Démonstrations with Garo cotton have been carried out in four centres in the Jaintia Hills and two centres in the Bhoi country. The seed supplied was very unsatisfactory and only a few plants germinated in each centre. The bolls produced were superior to the local ones. Fresh demonstrations are being made in each of Shillong, Jowai and Umran circles.

Demonstrations with local well-reputed paddy seeds are being carried out at five centres in the Jowai circles, two centres in the Umran, and one centre in the Mawphlang circles. As the demonstrations in the Umran and one in the Jowai circles were practically destroyed by cattle the results are neglected. The

results obtained from 1 seer of seed used in each of the remaining five centres were as follows :—

Mawkaiaw	...	...	...	46 lbs.
Raliang...	...	...	...	40 „
Barata ...	...	...	...	69 „
Shiliang myntang	...	...	...	44 „
Nongemai	...	...	...	32 „

The results were promising in suitable localities; a little more seed has been distributed free during the year.

The owners of the seeds distributed and demonstrated last year have also propagated the seed as instructed, and their reports are satisfactory.

Fresh demonstrations are being made and more seed distributed during the present year.

Demonstrations with ground nut have been carried out in two centres in each of Shillong, Mawphlang, Umran and Jowai circles and the yields obtained from ½ lb. of seed used in each centre vary from 1¼ pounds at Marbisu to 6½ pounds at Thangrain.

The demonstrations were quite promising in suitable localities and fresh demonstrations are being made during the present year.

During the year under report U Gloshon Singh completed the course of training at the Upper Shillong Farm and has since been appointed as a Demonstrator in place of U Sabir Singh, whose services were dispensed with last year.

R. S. N. Biswas, Demonstrator of Shillong circle was on privilege leave for two months and U Sedro Singh, an apprentice at Upper Shillong Farm, acted as his substitute. R. S. N. Biswas was transferred to North Cachar Hills towards the end of the period and H. Pascalis, Demonstrator, North Cachar Hills, was transferred to Shillong.

Bone-grinding operations in the Khasi and Jaintia Hills for the period.—As the bonecrushing installation at Upper Shillong was out of order no bone-meal was prepared during the period and consequently only a very small quantity of raw bones was purchased. The machinery has since been repaired and bones are now being crushed for application to the present crop.

On the 31st March 1919 the stock of raw bones stood at 113 maunds 7 seers and of bonemeal at 10½ seers. The total expenditure during the period was Rs. 1,607-5-0. This consisted mainly of the Calcutta cost, freight and other miscellaneous expenses for bonemeal purchased for demonstration purposes and for sale.

Formerly the Garo Hills formed part of the charge of the Agricultural Inspector, Khasi and Jaintia Hills, but for convenience of administration it has been handed over to the Agricultural Inspector of Goalpara from February of the present year.

Shillong,
The 14*th May* 1919.

J. W. McKAY,
Deputy Director of Agriculture,
Surma Valley and Hill Districts.

GLOSSARY.

Kharif	The rainy season.
Rabi	The cold season.
Ratoon	The second year's sugarcane crop grown from plants put down in the previous year.
Aus	Autumn rice.
Sail	Winter rice.
Asra	A shorts stemmed variety of deep water winter rice.
Dhaincha	Sesbania aculeata.
Cowpea	Vigna catiang.
Jowar	Andropogon sorghum var. vulgare.
Kalai	Phaseolus mung var. radiatus.
Khesari	Lathyrus sativus.
Musur	Lens esculenta.
Mung	Phaseolus mungo.
Gram	Cicer arietinum.
Coriander	Coriandum sativum.
Radish	Raphanus sativus.
Rape	Brassica Campestris.
Matikalai	Phoseolus mungo var.
Kulthikalai	Dolichos biflores.
Lucerne	Medicago sativa.
Wheat	Triticum vulgare.
Oats	Avena Sativa.
Sugarcane	Sacharum officinarum.
Beer seem	Trifolium alexandrium.
Soy beans	Clycine hispida.
Paddy	Oriza sativa.
Indigo	Indigofera tinctoria.
Groundnuts	Arachis hypogæa.
Sunn Hemp	Crotalaria juncea.
Job's tears	Coir lachryma.
Raishan	Paspalum sanguinale.
Maund	82⅔ pounds.
Jhum	A system of cultivation consisting of paving and burning the surface.
Guinea grass	Panicum jumentorum.

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